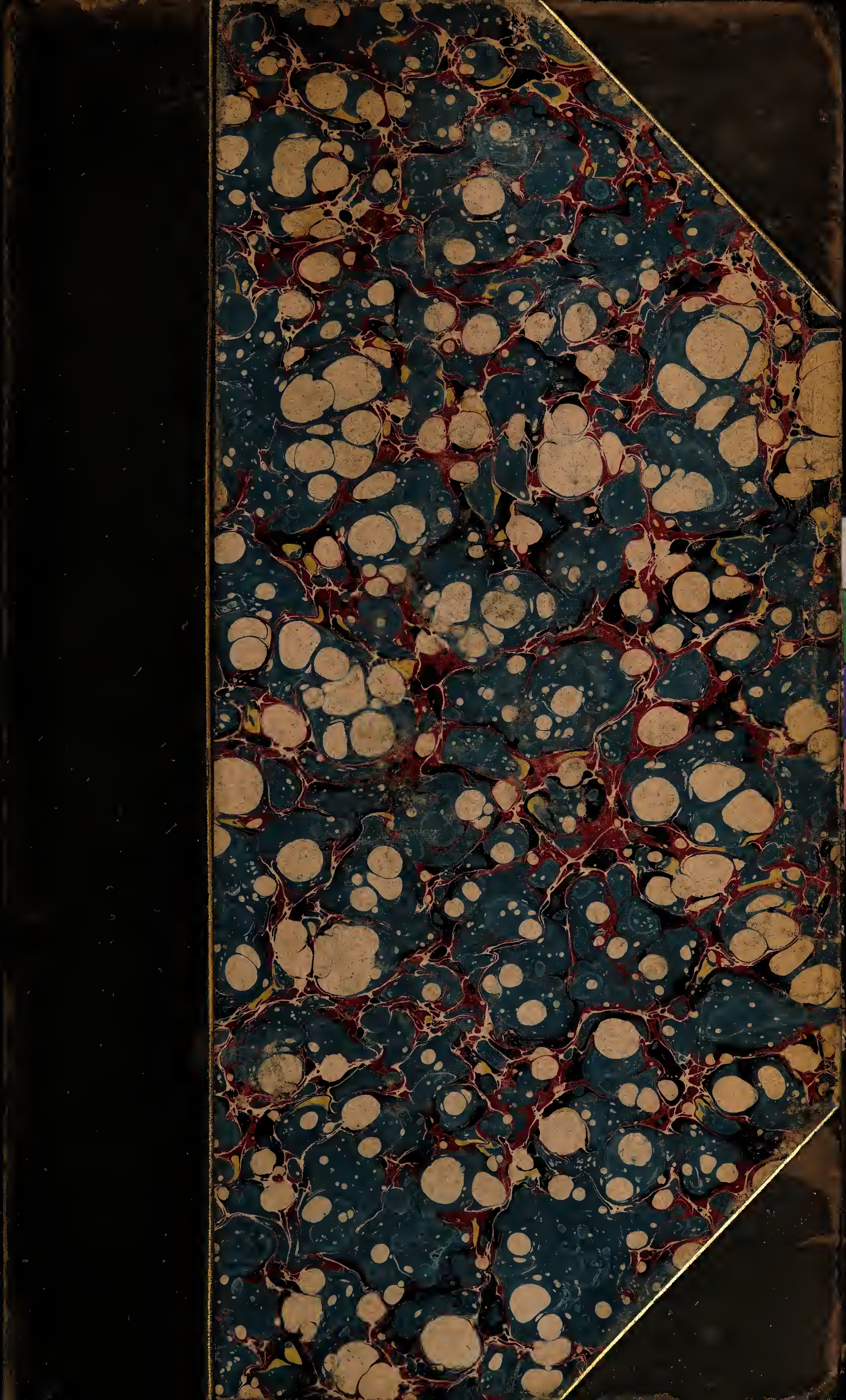

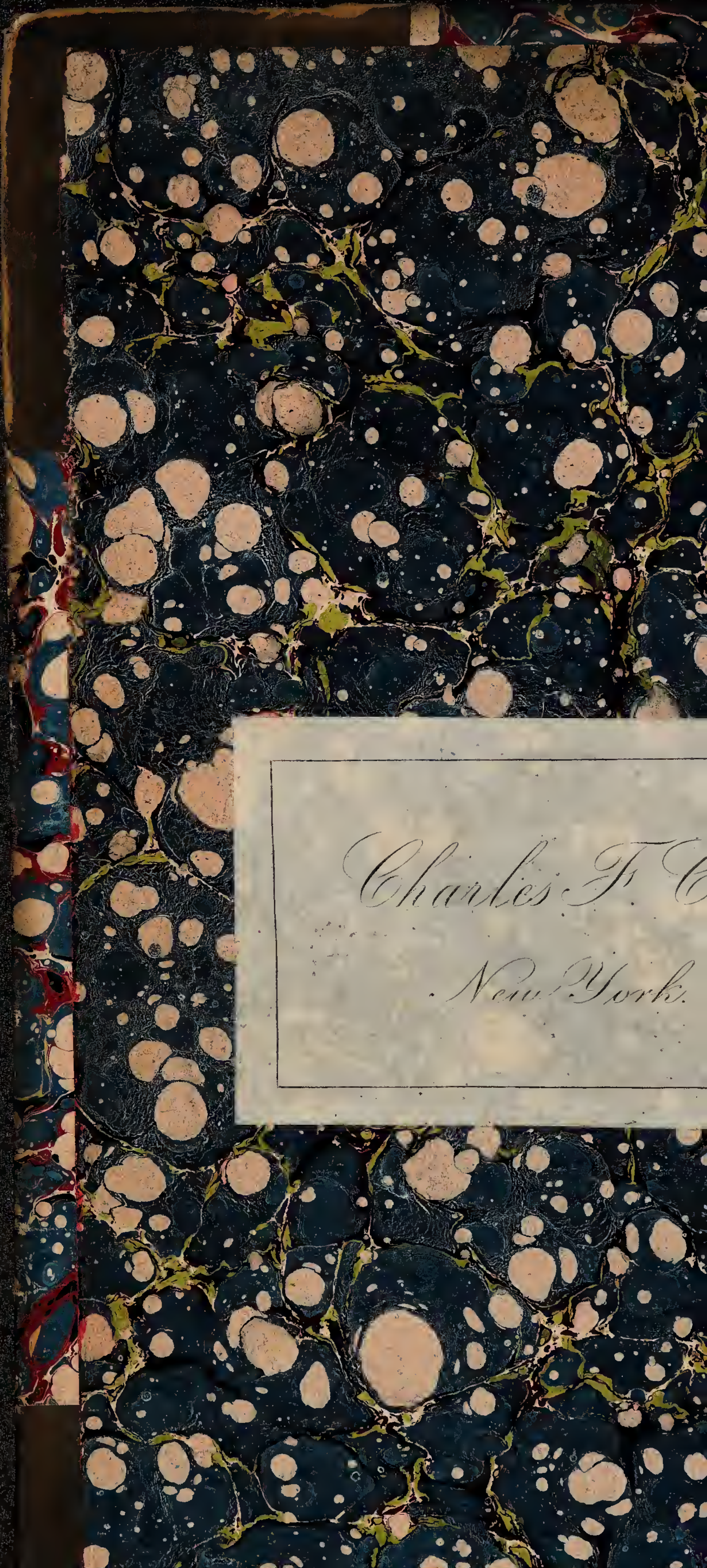

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No vulgar Eye enjoys a fond Delight
In Naturs Beauty and Productions bright;
This nursing Mother, is yᵉ Second Cause
Of Plenty, Life, and uncontroling Laws;
When Art doth Court her, She unveils her Face,
And shews her Charms to her adopted Race.

Hulett Sculp

Arscott Bickford

Dunsland

THE LABORATORY; OR, SCHOOL *of* ARTS:

In which are
Faithfully EXHIBITED, and fully EXPLAIN'D,

I. A Variety of curious and valuable Experiments in Refining, Calcining, Melting, Aſſaying, Caſting, Allaying, and Toughening of *Gold*; with ſeveral other Curioſities relating to *Gold* and *Silver*.

II. Choice Secrets for *Jewellers* in the Management of *Gold*; in *Enamelling*, and the Preparation of *Enamel* Colours, with the Art of Copying precious Stones; of preparing Colours for *Doublets*; of Colouring *Foyles* for *Jewels*, together with other rare Secrets.

III. Several uncommon Experiments for Caſting in *Silver*, *Copper*, *Braſs*, *Tin*, *Steel*, and other Metals: Likewiſe in *Wax*, *Plaiſter* of *Paris*, *Wood*, *Horn*, &c. With the Management of the reſpective Moulds.

IV. The Art of making *Glaſs*: Exhibiting withal the Art of Painting and making Impreſſions upon *Glaſs*, and of laying thereon *Gold* or *Silver*; together with the Method of preparing the Colours for *Potters* Work, or *Delf*-Ware.

V. A Collection of very valuable Secrets, for the Uſe of *Cutlers*, *Pewterers*, *Braſiers*, *Joiners*, *Turners*, *Japanners*, *Book-binders*, *Diſtillers*, *Lapidaries*, *Limners*, &c. together with the Art of Marbling *Books* or *Paper*.

VI. A Diſſertation on the Nature and Growth of *Salt-petre*: Alſo, Several other choice and uncommon *Chymical Experiments*.

VII. The Art of preparing *Rockets*, *Crackers*, *Fire-Globes*, *Stars*, *Sparks*, &c. for Recreative *Fire-Works*.

VIII. The Art and Management of Dying *Silks*, *Worſteds*, *Cottons*, &c. in various Colours.

Compiled from GERMAN, *and other foreign* AUTHORS.

Illuſtrated with COPPER PLATES.

By G. SMITH.

The THIRD EDITION,
With Additions of a great Number of valuable Receipts; particularly, A ſhort, plain, and eaſy Introduction to the Art of drawing in PERSPECTIVE.

LONDON:
Printed for JAMES HODGES, at the *Looking-Glaſs*, facing St. *Magnus* Church, *London-Bridge*; and T. ASTLEY. 1750.

19153

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TO

MARTIN FOLKES, Eſq;

SIR,

THE Honour I preſume to do myſelf in preſenting You with a new Edition of the LABORATORY, *or* SCHOOL *of* ARTS, will not, I flatter myſelf, occaſion Your Diſpleaſure, but meet with a favourable Acceptance: The Reception this Book has met with from the Publick has engag'd me to augment this third Impreſſion with a conſiderable Number of ſcarce and valuable Receipts and Inſtructions for the Benefit of ſuch as delight in acquiring uſeful Knowledge, and whoſe Endeavours aim at the Improvement of their Faculties by trying Experiments, which have a Tendency to their own and the Publick Advantage.

I cannot, without ſome Concern, reflect on the great Diſappointment I meet with in the Publication of a Work of far greater Conſequence,* which, *Sir*, had the Sanction and Approbation,

---

* The *Acta Germanica*, or Literary Memoirs of *Germany*, *&c.*

not only of You, but likewiſe of a conſiderable Number of other Gentlemen of Learning and Judgment, who deem'd it *a Work, which would be both agreeable and ſerviceable to the Publick*: But, for want of ſufficient Encouragement, I have been under a Neceſſity to ſuſpend the farther Continuation thereof: However, I ſtill flatter myſelf, that by Your Patronage, and the Recommendation of thoſe other Gentlemen, who are Well-wiſhers, and have already been Promoters of it, a Subſcription will be ſet on Foot, which may enable me to go on with Chearfulneſs, not only to finiſh the Second Volume, but likewiſe to compleat my Deſign.

Be pleaſed, Sir, to pardon this Digreſſion, as foreign to the Purpoſe of a *Dedication*, and accept of the preſent Performance, in Token of Acknowledgement for Your kind Offices in promoting the above Undertaking, while craving the farther Continuation of Your Favour and Intereſt, I do myſelf the Honour to ſubſcribe myſelf,

SIR,

Your moſt obliged and

moſt obedient humble Servant,

GODFREY SMITH.

THE

PREFACE.

NATURE, the Mother of all viſible Beings; or to ſpeak more Chriſtian-like, the Wiſdom and Power of God, have diſcover'd themſelves throughout the Univerſe, in the moſt admirable and ſurprizing Productions. The Wonders and innumerable Curioſities of our particular Syſtem, raviſh the Eyes of every Beholder, who is thereby incited to acknowledge and adore the Supreme Being, and firſt intelligent Cauſe of ſo glorious a Frame.

BUT the Manifeſtation of God's Perfections, was not the only Deſign of ſuch a Profuſion and Variety of Wonders, it was alſo deſign'd for the preſent Uſe and Benefit of Mankind, which is alſo, properly ſpeaking, a Diſplay of the Divine Goodneſs. In them we find a Plenty of every Thing to ſupply our Wants, and all Manner of Helps to bring to Perfection the moſt uſeful Arts. For though Nature has hid the beſt, and even the richeſt Part of her Productions, either in the Deep, or in the Bowels of the Earth, yet is ſhe willing and ready to lay her Treaſures open to our diligent Enquiries, to our Contemplation and Uſe. The more a Man applies himſelf to ſuch Reſearches, the better he anſwers the End of his Creation: But the leſs he is endued with that Spirit of Enquiry, the nearer he reſembles the Brutes, who enjoy the preſent Objects, without reflecting on their Beauty, Variety and Uſefulneſs; without attending to any thing elſe but what makes an actual Impreſſion upon their Senſes. Such are the People who trample on Arts and Sciences, and deſpiſe thoſe who apply themſelves to Mechanick Arts, as well as ſuch who endeavour to be uſeful in that Reſpect to their Fellow Creatures.

I DON'T doubt but there will be many of that Kind (for with ſuch the World abounds) who will ſet their Wits at work to find Fault with this Performance, either as to the intrinſick Merit of it, the Truth of ſome Experiments, or the Tranſlator's Stile. But to be beforehand with thoſe Gentlemen, and to ſave them ſome Trouble, I freely own myſelf to be a Foreigner, who has had no great Share of School, much leſs of Univerſity-Learning. Nevertheleſs, I can ſay without Vanity, that I am not deſtitute of Common Senſe and ſome Share of Reading.

I HAVE endeavour'd to tranſlate and compile this Work in a plain, eaſy and intelligible Manner; and if there is any Fault, in Point of Grammar, or Orthography, Gentlemen of good Senſe and good Nature will eaſily excuſe Trifles, in Conſideration of the Uſefulneſs of the Work itſelf.

HOWEVER, we may venture to ſay, that altho' it was deſign'd chiefly for the Ingenious Lovers of Arts, unſkill'd in Languages, with whom moſt Countries abound, yet the Learned themſelves, may find therein Variety of Matters, not unworthy their Notice.

AS to the Truth of the Experiments, I muſt own, that had my Fortune anſwer'd my Inclination, I would have carefully examin'd moſt of 'em before-hand: but as that was not the Caſe, I ſhall leave it to thoſe Gentlemen, whoſe Purſes may be equal to the Taſk, to ſatisfy their Curioſity. I have, however, try'd ſome of them, and they have anſwered my Expectation, which gives me room to believe that the reſt are as true. Beſides, I have conſulted People whoſe Province it was to be better acquainted with thoſe Particulars: Or, when I could not have ſuch an Opportunity, I have weigh'd them the beſt I could, and duly examined their Probability, and the Credit of the Authors; So that I dare ſay, moſt (if not all) of thoſe Experiments will ſtand the Teſt.

I KNOW, Objections have been raiſed againſt a few Articles here and there, particularly that concerning *the Generation of Silk-Worms out of Veal*; but preſume that Experiments made to prove the Truth of this Fact, which we have inſerted in this Impreſſion, will induce Gentlemen not too haſtily to form a Judgment on the ſuppoſed Improbability of the Thing, but to wait 'till Trials perform'd by themſelves or others ſhall determine whether ſuch Facts really be as they are repreſented, or not.

WHEN firſt this Book was put to Preſs, I had ſome Hints given me, that the Publication thereof would give Offence to Tradeſmen or Artificers, whoſe Myſteries in their reſpective Profeſſions, would be by that Means laid open to every Body. But as this Argument ſeem'd to me to be of little Weight, I did not think proper to deſiſt from this Undertaking: They who are in a good Way of Buſineſs, will hardly neglect it or leave it off, in Hopes of making a better Fortune, by trying of Projects. And ſuppoſing ſome ingenious Perſons ſhould, by their Induſtry, in trying and putting any of the Experiments in Execution, better their Fortune, or get an honeſt Livelihood, where would be the Harm? Muſt a Man for fear of diſpleaſing a few private Perſons be debarred from the Knowledge of Things, which may be advantageous, both to himſelf and his Country, and be deny'd the Satisfaction in curious Inquiries? my Aim in the Publication of this Work is to hurt no Body, but to oblige the Curious and Lovers of Art and Ingenuity, who take Pleaſure in trying Experiments of one Sort or other; Amuſements much more delightful and ſatiſfactory to ſome Gentlemen than Gaming, Hunting, Reading of Novels, and the like. Artificers and Handy-Craftsmen will find it a very uſeful Performance. They will, perhaps, make ſome new and advantageous Diſcoveries relating to their Trade, which before they were ignorant of. The Selfiſhneſs and Ill-nature of ſome Maſters is ſuch, that they will keep their Apprentices, during Seven Years, on particular ſervile Branches, and conceal from them the moſt eſſential Part of their Buſineſs by doing Things in private. It concerns thoſe who have labour'd, or do labour, under ſuch an unjuſt or ungenerous Proceeding, to ſtrive to be better inform'd. And to many of ſuch this Book will not be a uſeleſs Purchaſe, if they peruſe it with Attention, and try the Experiments, as far as lies in their Power.

As two Impreſſions of theſe my Endeavours have met with a favourable Reception from the Publick, I hope they will, in this Third Edition, ſhare the ſame Fate, the more, as the additional Number of very valuable Receipts and Inſtructions is conſiderable: They are the Fruits of a good Intention, and preſented to the Curious with Sincerity.

THE LABORATORY, OR, SCHOOL of ARTS, &c.

PART I.

A Variety of curious and valuable Experiments in Refining, Calcining, Melting, Aſſaying, Caſting, Allaying, *and* Toughening *of* GOLD; *with ſeveral Curioſities relating to* GOLD *and* SILVER.

AS Gold of all other metals is the moſt noble and moſt valuable, it is juſtly diſtinguiſh'd from all the reſt by the name of the *King of Metals*. *Europe* as well as the other parts of the World, affords ſeveral Gold mines; but *Peru*, in the *Spaniſh Weſt-Indies*, particularly abounds in them; from whence almoſt every nation is ſupplied with it.

Of all metals, Gold is the moſt ſolid: It conſiſts of particles ſo fine and cloſely connected, that it is a difficult matter to ſeparate it: It will reſiſt the fire, and not ſuffer any diminution by the heat thereof, though never ſo fierce and violent. It is not ſubject to ruſt, but retains its natural colour. Its weight is ten times heavier than earth, and a piece of Gold contains ſeven times the matter that a piece of glaſs doth of the ſame magnitude. It is of a malleable temper, and ſpreads under a hammer more than any other metal, and by the hand of a ſkilful artiſt, may be wrought into any form or ſhape. There is no ſolid body that can be extended ſo much as Gold; one ounce beaten into leaves, would cover ten acres of gound, Wiredrawers extend out of an ounce of Gold a thread of 230800 foot long.

Gold being then of a pure and ſolid ſubſtance, its intrinſic value cannot be diminiſh'd by the moſt violent fire, nor any other means, but only by the mixing and incorporating it with other metals, and when this is done, its purity or value is diſtinguiſh'd by the number of carats. The fineſt Gold, which is free from any allay, is commonly call'd Gold of 24 carats, and as many carats there be below that number, ſo much is the Gold leſſon'd from its original value, according to the proportion of the allay of ſilver and copper, ſo that $\frac{1}{4}$ of ſilver and $\frac{1}{4}$ of copper to $\frac{1}{2}$ of Gold, being incorporated together, makes a Gold of 12 carats, and ſo on.

To ſeparate the Gold from the Ore.

AT the Gold Mines in the kingdom of *Hungary* they have ſeveral ways of ſeparating it ; as burning, melting, and adding ſilver ore and other minerals, ſand and lead, according as the ore is fluid or fix'd : For the generality they proceed thus ; they break and pound the ore very fine in water ; they waſh it often, and lay it in powder upon cloths, and by a gentle oblique deſcent of the water over it, and their continual ſtirring it, the earthly, clayey and lighter parts are waſhed away, while the heavier and metallick remain in the cloth : Theſe cloths are afterwards waſhed clean, in ſeveral tubs, and the water after ſettling a little, is poured off from its ſediment ; which ſediment is again waſhed, and ſtirred up in ſeveral veſſels and troughs, 'till at length they ſprinkle quickſilver upon it, and need it well together for an hour, and then they waſh it again in a wooden veſſel, ſtriking the veſſel againſt their leg, they bring the Gold and quickſilver together into an amalgama : From this amalgama they ſtrain as much of the quickſilver as they can, firſt thro' coarſe, and then thro' fine cloths ; the remaining maſs is put upon a perforated plate, which is ſet over a deep pan placed in the earth, in the bottom of which pan they alſo put quickſilver ; and this pan is covered, and well luted ; then they make a charcoal fire upon it, and by that means drive down the quickſilver which might ſtill remain in the Gold, to the reſt in the bottom of the pan ; then taking out the Gold, they give it a ſmart fire, that it may ſtill become purer.

Of SILVER.

THE fineſt metal next to Gold is Silver, which is of a more ſmooth and poliſh'd nature than gold; it is malleable, but will not ſo eaſily yield or extend under the hammer, neither is it ſo weighty as gold.

Silver is ſeldom found in mines by itſelf, but commonly accompany'd or mix'd with copper, lead, or gold. That mix'd among lead lies in a kind of black ore; but what is found in copper, is for the generality in a hard white ore, reſembling cryſtal. Sometimes pieces of pure ſilver are found in mines ſo hard, that it cannot be melted without the addition of a quantity of other ſilver. There being a great variety of ſilver ore, both to its mixtures, ſo likewiſe to its richneſs; ſome containing a great proportion of ſilver to what others do; 100℔. weight of ore ſometimes yields but ½ ounce or an ounce of ſilver; ſometimes 2, 3, 4, 5 to 20 ounces: Richer ore is very rare; yet, there has been ſuch as contain'd half ſilver, and ſome ſo rich, as to be work'd into ſilver utenſils without refining it.

A ſpecimen of each ſort of ore is carried to an office, call'd the Taſte, where its richneſs is examin'd into by the following method: They take the ſame quantity of the different ores, after firſt drying, burning, and grinding them, and give to each an equal proportion of lead, then melt and purify them, and by exact ſcales obſerve the proportion between the ore and its contain'd metal, and make a report thereof to thoſe employ'd in the large melting furnaces; If the ore is found to contain 2½ ounce or more to 100 ℔ weight, they melt it by the help of iron-ſtone, call'd *Kys*, and ſlacken, a ſcum, or cake taken off from the top of the pan, into which the melted mineral runs. If the ore be poorer and contains only 2 ounces or leſs to 100 ℔ weight, it is firſt pounded, and then much of the earthly parts are waſh'd away, 'till it becomes richer, after which it is thrown into a furnace with the former materials, where it melts, and runs thro' a hole at the bottom into a pan, placed in the earth before it, and thus expoſed it immediately acquires a hard ſcum, droſs or cake, which being often taken off, the remaining metal becomes purer; to which lead is added, and after ſome time the melted metal is taken out, then being again melted in the driving furnace, the lead and what elſe is mix'd with the ſilver is driven off by the blowing of two large bellows, and runs over in the form of Litharge; that, which firſt comes is the white, and that which comes laſt is the red Litharge.

Of REFINING.

REFINING or purifying of gold or ſilver, is an art by which the impurities that are mix'd with theſe metals are ſeparated, and this is done, four ways, *viz.* by parting, the *teſt* *, cementation, and by mercury.

Parting is done with *aqua fortis*; which the refiners make thus; They take of ſaltpetre 3 ℔. dantzick vitriol 2 ℔. and mix them in a morter, and put the powder into a long-neck, or earthen veſſel ſo call'd from its figure: Six or eight of thoſe long necks thus filled are placed in each ſide of the furnace in a range built with iron bars, at about 9 inches diſtance from each other, and cloſed at the ſides with bricks, the upper arches are left open to put in and take out the pots: Over the arches they lay large bars of iron, and then they cover all the top of the furnace with loam, the body of each long-neck lying expoſed to the fire, and the neck without, to which the receivers of glaſs are well luted; the lute is made of good loam, ſome horſe dung, and a little colcothar. Tho' the two former will do pretty well, in caſe the latter is not to be had: The luting being well mix'd and applied, they make a gentle charcoal fire under the pots for 3 hours, and then they increaſe it for 3 hours more, about the ſeventh hour they make a vehement hot fire for 4 hours, and fling in towards the end well dry'd billets of oak, of the length of the furnace, whoſe flame ſurround all the pots, and finiſhes the work: Next day the receivers are care fully ſeparated from the long-necks, and the *aqua fortis* taken care of, and put by for uſe as occaſion ſerves.

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* The *teſt* is a round iron ring, ſome are made oval, about two, three, or more inches deep, according to their largeneſs and the quantity of the ſilver to be refined. This ring is fill'd with wood-aſhes well cleanſed, and preſs'd very cloſe; at the top there is a cavity, commonly ſunk with an iron ball for to contain the ſilver: Before the aſhes are quite dry, you put a cloth over it with fine aſhes of trotter bones, which you ſift upon, thro' a fine hair ſieve, then place it on a tile, in a wind furnace, cover it with a muffel, and make it red hot; when ſo, then put in the ſilver to be refined. *Vid. Plate.* II. *fig.* 1.

To Refine Gold from Silver by Parting.

PUT three parts or more of Silver to one part of Gold into a crucible, give it a briſk fire, and when in fuſion, granulate it; then, after you have dry'd the grains, put them into *aqua fortis*, wherein the Silver will diſſolve, and the Gold will precipitate and ſettle to the bottom, in a powder. After the Gold is ſettled, pour off the diſſolution of Silver, waſh the Gold powder with clean water, and ſweeten it from all the ſharpneſs of the *aqua fortis*. Then dry and melt it in a ſmall crucible, with a little borax or ſaltpetre; and when in fuſion, and looks of a bright colour, caſt it into an ingot or mould you have for that purpoſe. *See Plate* II. *fig.* 5.

To bring the ſolution of the Silver into a body, pour it in a thick-bottom'd copper bowl, that is thorough clean; add to it ten times the quantity of clean water, and the whole will turn of a sky colour; fling a little ſalt into it, ſtir it about with a clean wooden ſtick, and the Silver will precipitate to the bottom of the conſiſtence of a thin paſte. After it has ſetled for three hours or longer, pour off the water into another clean copper bowl, and add ſome warm water to the ſediment, which will alſo turn to a sky colour, but paler than the firſt; repeat this till the water comes off clear, and the Silver remains free from all ſharpneſs or ſalt. Warm the firſt blue water in the bowl, fling a little ſalt into it, and the Silver that remain'd will ſettle at the bottom. Pour off the water, dry the ſediments, and then, after you have greas'd or wax'd your crucible, melt them therein with a little borax.

How to granulate Silver in the beſt Manner.

TAKE a twig or two of a birch-broom, with theſe ſtir the water, in which you deſign to granulate, in a circular motion, at the ſame time pour your ſilver with diſcretion into it, between the branches of the twigs; and the proceſs will anſwer to your ſatisfaction.

Another Method to ſeparate Gold from Silver.

TAKE the Silver which contains Gold, granulate it, or elſe caſt it into an ingot; then hammer it into thin plates, and cut them in little pieces, roll them up in ſcrolls, ſo as not only to convey them eaſily thro' the neck of the matraſs, but alſo to prevent the plates laying upon one another, which would hinder the operation. Then pour to one ounce of ſilver, two ounces of *aqua fortis*; ſtop your matraſs, yet ſo as to give it a little vent; place it over a coal fire, and let it leiſurely advance to working and boiling; continue it thus till the Silver is wholly diſſolved, and the *aqua fortis* looks of a clear colour. If the Silver contains any Gold, you will ſee it ſettle at the bottom of the matraſs, in a blackiſh powder; but if there appears little or no black ſediment, it is a ſign the Silver contains no Gold.

Pour the ſilver-water from off the ſediment very gently and carefully into a glaſs or pan, ſince there is in every drop a mixture of Silver; but particularly take care of the black ſediment, for that is the Gold calx.

To this Silver-water put ten times the quantity of rain or river-water, which is better than ſpring-water: and at the bottom of the pan put a red hot plate of copper, which will cauſe the Silver to precipitate to the bottom, and by degrees to hang to the plate, ſo as to cover it.

On the black ſediment pour about an inch high of clear water, which will for the firſt and ſecond time turn whitiſh, becauſe of the Silver that remains therein; add this water to that in the glaſs, and continue pouring of water on the Gold calx, till it comes off clear: then put the Gold calx, into a ſmall crucible, drain off the water, and let it dry; melt it in the ſame crucible with a little borax, and you will have the pureſt Gold.

To try whether there is any Silver remaining in the water; fling a little ſalt in it, and let it ſtand all night to ſettle; if there is any, the water will turn turbid and muddy, but if there is no Silver remaining, the ſalt will ſettle at the bottom of the glaſs, and the water remain clear. After it has ſettled 24 hours or more, pour the clear water from off the top, and put the ſediment, which is the Silver calx, into a crucible, which has been warm'd and the inſide wax'd all over; in this

PLATE I.

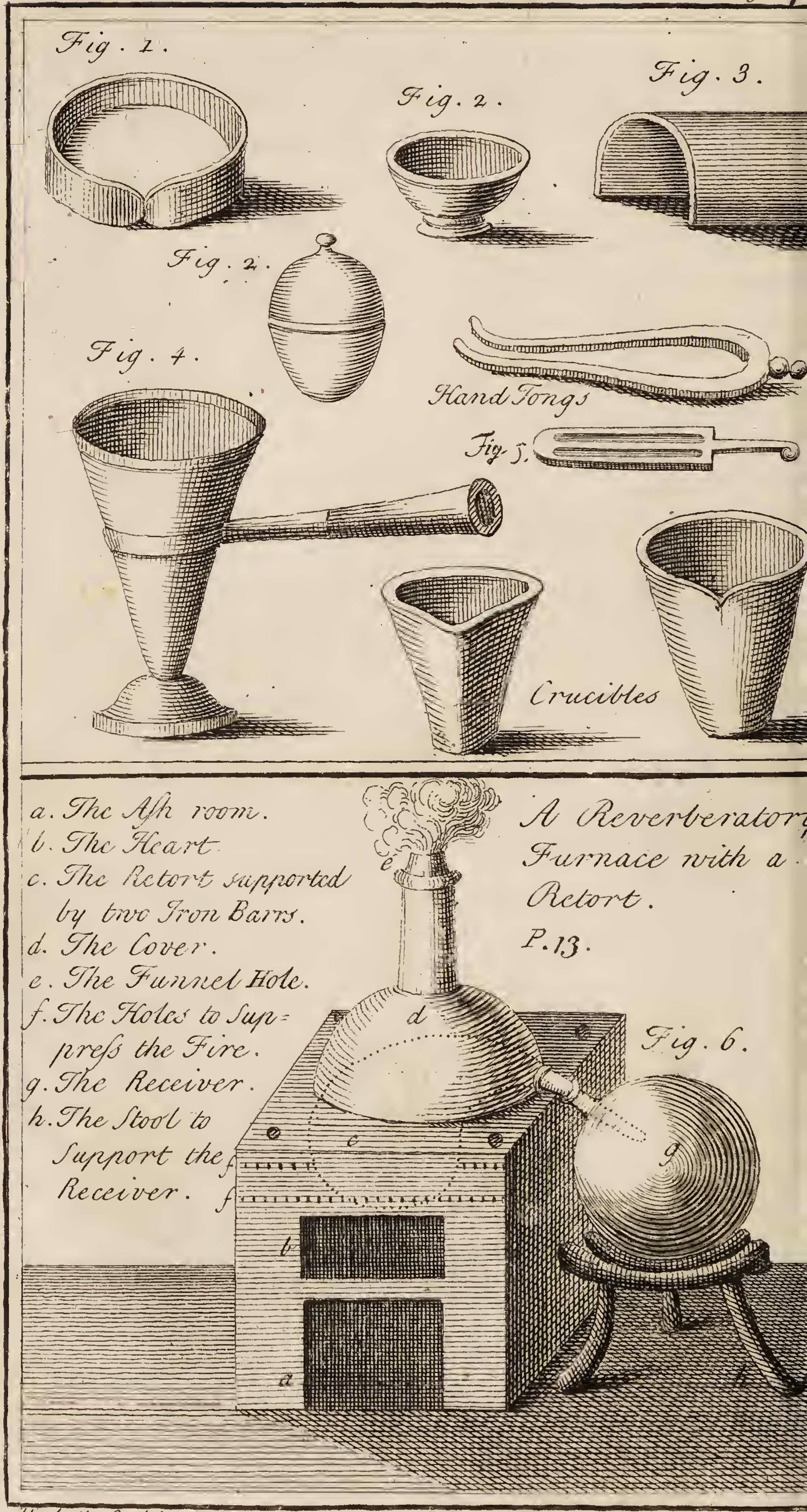
Fig. 1.
Fig. 2.
Fig. 3.
Fig. 2.
Fig. 4.
Hand Tongs
Fig. 5.
Crucibles
a. The Aſh room.
b. The Heart
c. The Retort supported by two Iron Barrs.
d. The Cover.
e. The Funnel Hole.
f. The Holes to Suppreſs the Fire.
g. The Receiver.
h. The Stool to Support the Receiver.
A Reverberatory Furnace with a Retort.
P. 13.
Fig. 6.
a
b
d
e
f
f
g
h

Hulett Sculp

let the calx ſettle, then pour off the clear water; when the calx is dry, melt it as has been directed, and you will have the pureſt Silver for uſe. This is the ſhorteſt manner of ſeparating theſe metals.

To ſeparate Gold or Silver from other Metals.

TAKE your coppel*, and put it under a *muffel*†, which cover all over with live coals, adding dead ones to them, and by degrees augmenting the heat, till both the muffel and coppel are red hot. Then put, according to your quantity of gold or ſilver, a proportionable quantity of lead into the coppel, which is commonly four parts of lead to one part of gold or ſilver. When the lead is melted, and of a ſparkling and fine quickſilver colour, then put your gold or ſilver upon it, and it will melt preſently: give it a briſk fire, and the baſer metals will mix and unite with the lead, but the gold or ſilver remain in the middle, clean and purified from all droſs, which fixes itſelf to the ſides like a ſcum; this you take off, preventing its entering into the pores of the coppel, and this is what is called *litharge*. Continue the fire till you obſerve no riſing of fumes.

By theſe means gold and ſilver is ſeparated or purify'd from droſs and other metals and impurities.

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[*] The *coppel* is made like an earthen cup, not glazed, but able to withſtand the fire; this lin'd throughout with paſte, made either of wood aſhes, or the aſhes of bones, mix'd up to a maſs with either ſtrong beer, urine, or whites of eggs. The wood aſhes are waſh'd in ſeveral waters, till they have loſt all their filth and ſalt, and the water comes off clear and ſweet, as when firſt put on. The bone aſhes loſe their ſalt in the fire, and are commonly burnt of trotter bones, or thoſe of calf's heads; ſome prefer fiſh bones before any other: The aſhes, whichſoever are uſed, muſt be ſifted through a fine hair ſieve. After having prepared this paſte or maſs, the cup is lined all over the inſide very ſmooth and neat, leaving only a cavity or a hollow in the middle, to hold the matter that is to be *coppel'd*, and then it is ſet to dry. The ſize of theſe *coppels* are made to the quantity of the metal to be purify'd. See *Plate* II. *fig.* 2.

[†] A *muffel* is made of one part of clay, mix'd with one part of ſand and two parts of horſe dung: work up this, firſt in a ſquare flat, with a rolling pin, to the thickneſs of a crown piece, and then bend it into an arch, and let it dry. Some only uſe pipe-clay by itſelf. See *Plate* II. *fig.* 3.

To refine Gold by Antimony.

TO one ounce of gold take four ounces of antimony, melt the gold in a proportionable crucible; at the ſame time melt the antimony in another large crucible, and throw the gold into it, then make it red hot; when ſo, caſt it into a braſs cone*, but let the inſide be a little warm'd and greaſed with tallow before you uſe it; then with a piece of wood, or with a handle of a hammer, knock pretty hard and quick upon the rim, which promotes the gold's ſinking to the bottom; when cold, turn it out of the cone, and you will ſee the *Regulus*; beat it gently off with a hammer, and lay it by. Then take the *Antimony*, put it into the ſame crucible, melt it as before, and when turned out, you will find a little *Regulus*; if you think you have not all the gold, you may repeat it a third time. When this is done then ſeparate the remaining *Antimony* from the gold, thus: Take a pretty large crucible, put the *Regulus*, and a handful of *Saltpetre* into it; then take another crucible fitted in the former, make a vent-hole in the bottom, and turn it upſide down, ſo that the hole may be uppermoſt. When the wide ends of the crucibles fit well, take a lute, mix it with ſome pounded glaſs, and lute it well; let it dry very well before a fire, then take a brick-bat, put it in your melting place, and lute your crucible upon it: This done, lay a little ſmall fire about it; on that lay deal charcoal, to the top of the upper crucible, but take care the hole be not covered: As the heat of the fire augments, ſo the *Saltpetre* goes off in ſtrong fumes through the hole. When the fumes ceaſe, give it a ſtrong heat for an hour or leſs, according to quantity; then take the crucible out of the fire, and let it cool; or elſe when you ſee the crucible turn black, you may quench it in a pail of water; knock off the bottom of the crucible, and you will find the gold refin'd; then take a clean proportionable crucible, put a little *Borax* and the gold into it, melt and caſt it into an ingot. This is the fineſt gold poſſible.

To prepare a Crucible ſo as not to contract any Gold, tho' it is for ſeveral Hours in the greateſt Heat.

TAKE a good crucible, which will ſtand the fire, warm it a little, and ſmeer or rub it over with a rine of bacon, both inſide and outſide; then put it in a warm place to dry; when dry repeat rubbing it over again as before and let it dry: this you do for 3 or 4 times. This done, warm your crucible again, and ſmear it both out and inſide plentifully with ſoap, then put it to dry, and before you uſe it, put it on a charcoal fire, and the ſoap will burn in a flame, when it is burnt out, then you may uſe it for melting gold or ſilver, and it will attract nothing of theſe metals as your common crucible will.

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* See the figure of a *Cone. Plate* II, *fig.* 4.

A Method of purifying Gold, by way of Cementation.

CEMENTATION is a ſingular and uſeful art, by which gold may be purify'd from the allay of any other metal; and this is done by means of a moiſtened powder, which eats and conſumes the impurer metals in it: But it is to be obſerv'd, that this cementation is only to be uſed where the gold has the predominancy; otherwiſe if there ſhould be more ſilver or other metal than gold, it is better to perform the ſeparation with *Aqua Fortis*, as has been directed.

The cementing powders are prepared of ſuch ſalts and ingredients as by their acrimony or ſharpneſs conſume the ſilver or copper.

To theſe are alſo added, * *Æs uſtum*, which gives the gold a fine colour; alſo *Blood-ſtone*, *Tutia*, *Crocus Martis*, calcin'd *Vitriol*, and ſeveral other things, heighten the beauty of that metal.

Brick-duſt is uſed in this cement, in order to receive the allay, whether it be ſilver or copper, or any other metal, from the ingredients that attract and ſeparate them from the gold, which otherwiſe would adhere to the gold. I ſhall here ſet down a few receipts of ſuch cements as have been tried with ſucceſs.

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* *Æs uſtum* is prepared thus; Stratify plates of copper with powdered ſulphur in a large crucible, cover and lute it with a cover that has a hole in the middle; to give vent for the fumitation, give it a ſtrong fire in a wind-furnace, ſo long till you ſee no exhalation of vapours; then take off your plates whilſt hot, ſeparate them; and when cold, beat them to a powder, which is the *Æs uſtum*.

TAKE fine brick-duſt one part, and fine pounded ſalt, one part, moiſten and mix them with vinegar, and fill a crucible half full, then ſtratify plates of gold, or gold coin, with the 'foreſaid mixture or paſte, and preſs it cloſe down; repeat this as you have occaſion, and put a thick layer a-top; then cover and lute the crucible cloſe, that nothing may evaporate: When this is done, fix your crucible upon a high brick, in the middle of the furnace, give it a violent heat for 12 hours, and the ſalt will eat and conſume the impurities of the gold, and attract it into the brick-duſt. *Or,*

TAKE in weight of ſaltpetre, of allum, and of ſal-armoniac, one part; two parts of vitriol; four parts of ſalt; eight parts of brick-duſt, and mix them with vinegar; ſtratify this mixture and the gold, as before directed, in the crucible; cover and lute it well, and give it a violent fire for an hour or two, and let it cool of its ſelf; but before it is quite cold, take out the gold, fling it into white-wine vinegar, and boil it therein; then bruſh it, and after you have done this, heat it red hot upon an iron plate. *Or,*

TAKE blood-ſtone two ounces, ruſt of iron, calcined vitriol, ſal-armoniac, verdegreaſe, one ounce of each; *Armenian Bole*, *Tutia*, ſalt-petre, allum, ¼ of an ounce of each; moiſten this mixture three or four times with vinegar; let it dry between while, then grind it fine, and proceed as directed; give it a ſtrong fire for three hours; which repeat three times.

To bring the ſilver out of the cementing powder or brick-duſt, mix it with glaſs and granulated lead, let it melt together, put it to the teſt, and you will have the ſilver again which was in the gold.

To ſeparate Gold and Silver out of the Sweepings.

TAKE ſweepings, put them into a pan well glazed, add a proportionable quantity of mercury to them, mix the duſt and mercury with your hands well together, ſo long till you think the mercury has extracted all the gold and ſilver from the duſt; then put the maſs into a piece of waſh-leather, and wring out the mercury, what remains in the leather will be like a paſte; put that into an alembick, and drive the mercury from it into a diſh with water, which put under the head to receive it; what remains, put to the teſt, refine it with lead, and ſeparate it with *aqua fortis.*

To ſeparate the Gold from gilded Copper.

TAKE four ounces of yellow brimſtone, two ounces of ſal-armoniac, one ounce of ſaltpetre, half an ounce of borax, and grind them fine with ſtrong vinegar, to a paſte; which lay thin over the gilded copper, give it a gentle heat, till the paſte is burned away, and the copper looks black, then take it out, and with a knife or other ſuch inſtrument ſcrape off the gold in a clean diſh, and it will come off very eaſy.

Another Method.

TAKE the root of *Bertram*, cut it fine, pour one quart of ſtrong white-wine vinegar upon it, put it into a boiling-pot, cover it with a lid, lute it well, and let it boil a little, then take it off the fire, and let it cool. After this take a copper cup, or any other thing that is gilded, neal it well, quench it in that liquid, and the gold will fall off from the copper to the bottom, which waſh, and then melt together in a crucible. *Or,*

TAKE fine ſal-armoniac two parts, ſulphur one part, grind them well together, anoint it with linſeed oil, ſtrew the powder upon it, hold the gilded piece to the fire over an earthen diſh with water; ſtrike it with an iron, and the gold will fall off into the diſh. *Or,*

TAKE ſaltpetre and borax, one ounce of each, diſſolve them in a little quantity of water; then neal your copper, and quench it in this water; repeat this ſeveral times, and the gold will fall to the bottom.

To ſeparate Copper from Silver, or any other Allay.

TAKE half an ounce of verditer or *Spaniſh* green; white vitriol and ſulphur, one ounce of each, allum half an ounce; boil all together in vinegar in a glaſs, put in your mixt ſilver; this will diſſolve and extract the copper, and the ſilver remain whole.

To extract the Silver out of a Ring that is thick gilded, ſo as the Gold may remain intire; a curious Secret.

TAKE a ſilver ring that is thick gilded, make a little hole through the gold into the ſilver, then put the ring into ſpirit of nitre in a warm place; it will extract the ſilver, and the gold will remain whole.

To make brittle Gold malleable.

PUT gold into a crucible, and give it a briſk fire in a wind furnace, or before the bellows; when the gold is ready to melt, fling gently upon it ſome good, dry and clear ſaltpetre, which will preſently flame, and promote the fuſion of the gold the ſooner, and the ſaltpetre will ſpread and cover the gold; then caſt it into an ingot, which before has been warm'd and anointed with wax. *Or,*

THE beſt way of all to make gold malleable, is this: Take human excrements, dry and calcine them in a crucible to a black powder; when the gold is in fuſion, fling ſome of this powder upon it, and give it a briſk fire; when the powder is conſumed, caſt the gold into an ingot, and it will be fine and malleable: if you extract the ſalt from the black powder before you uſe it, it will ſtill have a better effect, and that with a leſs quantity.

To make Silver that is brittle, pliable.

TAKE one mark of ſilver, half an ounce of glaſs, one ounce of ſaltpetre, a quarter of an ounce of borax, half an ounce of *ſal gemmæ*; put all this into a crucible, and cover it with a leſſer one that has a vent-hole at bottom, and lute it well; then give it a brisk fire, and continue it ſo long till you think the ſilver is diſſolved; then cover the crucible all over with live coals, except the vent-hole, and leave it to cool: take off the upper crucible, and you will find therein hanging all the impurities the ſilver contain'd and which occaſion'd its hardneſs: then melt the ſilver again in a crucible, and throw into it half an ounce of tartar finely ground, and when in fuſion, caſt it into an ingot, and you will have fine and malleable ſilver.

To give Gold, Silver, or other Metals, a quick Fuſion.

TAKE calcined *Venetian* ſoap, borax, glaſs-gall, or *Venice* glaſs, an equal quantity, grind and mix it well together, this will cauſe a quick fuſion. *Or,*

TAKE yellow amber, borax, glaſs-gall and ſoap, equal quantities, grind them together to a powder, and what you deſign to melt, let it be done with that compoſition.

To try whether granulated Silver contains any Gold.

TAKE ſome of thoſe ſilver grains, and rub them on a touch-ſtone; then with the end of a feather let fall a drop or two of *aqua fortis* upon the ſtrokes, and let them continue upon it for a little while; if it contains gold, you will ſee ſome remains of the ſtrokes, but if not, the ſtrokes will vaniſh.

To amalgamate Gold, or to mix it with Mercury, which is of Uſe to Gilders.

TAKE a penny weight of fine gold, beat it into very thin ſmall plates; heat them in a crucible red hot, then pour upon them 8 penny weight of quickſilver, revived* from cinnabar; ſtir the matter with a little iron rod, and when you ſee it begig to riſe in fumes, which quickly happens, caſt your mixture into an earthen pan, fill'd with water, it will coagulate, and become tractable; waſh it ſeveral times to take away its blackneſs; thus you have an *amalgama*; from which ſeparate the mercury, which you will find is not united, by preſſing it between your fingers, after you have wrapt it up in a linnen cloth.

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* Reviving of quickſilver from cinnabar, is thus perform'd: Take a pound of artificial cinnabar, powder it, and mix it exactly with three pound of quick lime, alſo powder'd; put the mixture into an earthen

Gilding upon Silver, Braſs, Copper, and Iron.

IF you would gild ſilver, take of the aforeſaid *amalgama*, and with it rub that, which you deſign to gild, cloſe every where, that it may receive gold all over, then hold it over a charcoal fire, or lay it upon it, and it will cauſe the quickſilver to fly away, after which you may heighten the colour with gilding wax, as ſhall be directed.

A particular Secret, to gild Silver to the greateſt Perfection.

TAKE *Crocus Veneris** and vinegar, add to them quickſilver, boil them together, till they come to the conſiſtence of a paſte; with this quicken or anoint the ſilver you intend to gild, and where-ever you quicken, it will turn of a reddiſh gold colour, which doth not happen when done with quickſilver only, for then it looks white: this is a curious ſecret; you may gild upon this paſte with leaf-gold, which otherwiſe

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then pot, or glaſs retort, whoſe third part at leaſt remains empty, place it into a reverberatory furnace, and after having fitted to it a receiver fill'd with water, let it reſt 24 hours at leaſt, ſtoke your fire by degrees, and at laſt encreaſe it to the height, and the mercury will run in drops, into the receiver; continue the fire untill no more will come: the operation is commonly at an end in ſix or ſeven hours: pour the water out of the receiver, and having waſh'd the mercury to cleanſe it from the little portion of earth it might carry along with it, dry it with linnen or the crums of bread, and keep it for uſe. See *Plate* II. *fig.* 6.

*Take the ſlips of copper, and quench them in urine, repeat this till it eaſily pulverizes. The powder you will find at the bottom of the urine, which preſerve for uſe.

therwiſe would require to be ground; it makes the gilding look rich, and of an high colour.

Another advantageous Manner of gilding on Silver.

TAKE tartar one part, ſalt two parts, pour water upon them and add ſome ſteel filings, boil the ſilver therein, till it becomes reddiſh, and this will require only the third part of what gold you would otherwiſe uſe.

A particular Method of Gilding, which may be done in a Moment, better than with Quickſilver.

TAKE the fineſt gold, diſſolve it in *aqua regis*† which has been prepared with ſalt, let the *aqua regis* be evaporated to half the quantity; then put the glaſs into a damp cellar, on ſand, and the gold will over night ſhoot into cryſtals, which take out, and let them diſſolve again in diſtill'd vinegar; put it again upon the fire, and let the half thereof evaporate, then put the glaſs again in the cellar, as before, in moiſt ſand, and over night the gold will ſhoot into cryſtals. Diſſolve theſe in rain-water, and evaporate that to half the quantity, and again it will ſhoot into cryſtals; when this is done, take the cryſtalline gold, grind it to powder with a knife, put that powder into the white of an hard boil'd egg, after the yolk has been taken out, ſet it in a cool and damp place, and over night it will diſſolve into an oil; and what ſilver you anoint with it, tho' ever ſo thin, drying it gently, you will find the gilding of a perfectly high and fine colour.

Gilding

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† The preparation of this *aqua regis* only differs from the following receipt, in uſing of ſalt inſtead of *ſal-armoniac*; the uſual way of making *aqua regis*, according to *Lemery*, is thus:

Powder four ounces of *ſal-armoniac*, and put it into a matraſs or other glaſs veſſel of a good bigneſs, pour upon it 16 ounces of ſpirit of nitre, place the veſſel in ſand a little warm, untill the *ſal-armoniac* is all diſſolved, then pour the diſſolution into a bottle, and ſtop it with wax. This is the right *aqua regis*.

Gilding after the Grecian *Manner.*

TAKE mercury ſublimate * and clear ſal-armoniac, of each one ounce, make a ſolution thereof in *aqua fortis*, then diſſolve it in fine gold, which is beaten very thin; let this ſolution evaporate over a coal fire, till it becomes an oil; then dip in it a ſilver wire, if it comes out black, and by nealing it in the fire, turns out gilded, it is right, and fit to be uſed for gilding any ſort of ſilver.

The true Italian *Gilding.*

TAKE common vitriol four ounces, allum two ounces, white vitriol one ounce, white lead one ounce, ſalt two handfuls, river water one quart, let it boil to half the quantity, and let it ſtand till it ſettles and looks clear, then it is fit for uſe.

To deaden Quickſilver for Gilding.

TAKE clear quickſilver, which is free from any mixture of lead, put it into a matraſs; and fling into it a handful of fine white ſalt, ſhake it well together, and let it ſtand for two days, then pour upon it ſtrong vinegar, let it reſt a day, and you will find a good quickſilver for gilding, and cheap.

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* Mercury ſublimate or ſublimate corroſive, is a mercury that is impregnated with acids, and by fire is raiſed to the top of the matraſs, or other veſſel.

Put one pound of mercury, revived from cinnabar, into a matraſs pour on it 18 ounces of ſpirit of nitre, ſet it on a warm ſand, and let it ſtand till all is diſſolved; this diſſolution put into a glaſs veſſel or earthen pan, ſet it on warm ſand to evaporate all the moiſture, the remains will be a white maſs, which beat to powder in a glaſs mortar, and mix with one pound of white calcin'd vitriol, and as much of decripicated ſalt: put this mixture into a matraſs, ſo as to leave two thirds empty; place it in ſand, give it firſt a gentle warmth for three hours, then augment the heat with laying on more coals, and a ſublimate will riſe to the top of the matraſs: the operation will require ſix hours time, when the matraſs is cold, break it, but take care to avoid a kind of light powder that flies in the air, when the matter is ſtirr'd. You will have one pound and above of very good ſublimate corroſive.

To boil Silver white.

FIRST neal your Silver on a charcoal fire, till it becomes a little reddiſh; then having boil'd it with an equal quantity of ſalt and tartar powder'd in a copper, with water, for a quarter of an hour, take it out and ſcratchbruſh it in clean water; then take good tartar, tie it up cloſe in a paper; put it in the fire ſo long 'till it has done burning and ſmoaking; grind it to a fine powder, mix it with clean water into a paſte, and with it rub over your Silver, this done neal it again, and ſquench it in cold water, bruſh what remains black upon it with a hair bruſh, and boil it for two minutes in tartar-water; then rince it in clean water, after you have wiped it with a dry rag, and your work will be done.

A Gold Powder.

TAKE leaf gold, or any other thin beaten gold, to the quantity of a penny-weight, or as much as you pleaſe, diſſolve it in twice its weight of *aqua regis.* Let half the ſolution evaporate in a ſand heat, then take dry'd linnen rags, ſoak them in the remaining liquid, dry them by a gentle heat, and burn them on a ſlow fire in a crucible, the powder, whereof will remain at the bottom, and be of a yellowiſh colour, and with this the gilding is perform'd.

Another for cold Gilding.

TAKE half a pound of *aqua fortis,* put into it two ounces of ſal-armoniac finely pulverized and white, let it diſſolve over a fire, and then filtrate it through a paper; put it into a matraſs, with as much fine beaten gold as will weigh two penny weight; ſet it on a ſlow fire, in order to diſſolve the gold into the *aqua regis.* When this is done, add to it two ounces of powder'd *ſal-gemmæ,* fine and clear, and let it diſſolve upon the fire; then take fine clean linnen rags, each about $\frac{1}{4}$ of an ounce in weight, dip them into that liquid, till all the ſolution is ſoaked, and having dried them, burn them to a powder, which preſerve for uſe. When you gild any thing with this powder, let the metal you deſign to gild be boil'd and ſcraped, that it may be clean and freſh; wet a piece of cork with ſpittle or water, and with it take up ſome of the powder, rubbing the places of the metal you are about to gild till it is yellow, after which bruſh and poliſh it. You may uſe inſtead of cork a ſoft leather ſow'd or ty'd to the round end of a little ſtick. *Or,*

TAKE of the fineſt gold the quantity of two pennyweight, and diſſolve it in *aqua regis*; add to this ſolution the weight of the gold of refined ſaltpetre, let that alſo diſſolve; this done, dip a fine little linnen rag, till it has ſoak'd up all, dry it gently, and burn it to powder. With this powder and freſh water gild your ſilver, by rubbing it with a cork, or a leather, faſtened to the knob end of a ſtick.

Another Powder to gild withal.

TAKE refined gold, beat it very thin, make it into little rolls, fling it into *aqua regis*, hold it in a matraſs over a ſlow fire, till all the gold is diſſolved, and the ſolution is turned of a yellow colour, then throw into it ſome pulverized cryſtalline ſaltpetre, by little and little, as much as it will conſume; then take ſome long narrow ſlips of old fine linnen, draw them through that liquid, and when they are thorough wet, hang them in the air to dry, in a glaſs bowl, or a piece of a broken bottle, and when thoroughly dry, light them with a coal, and let them thus, without flaming, conſume to aſhes. With theſe aſhes you may gild, rubbing it on the ſilver with a piece of cork. *Or,*

TAKE a penny weight of gold, with an equal weight of ſaltpetre, as alſo of *ſal-armoniac*, all which put into a matraſs with three quarts of *aqua fortis*; then put the gold nealing hot into it, and as ſoon as the gold is diſſoved, take ſome dry linnen rags, dip them therein, dry and burn them at a candle to tinder, which preſerve for uſe, as has been ſaid above.

A Quickening

A Quickening Water.

TAKE one ounce of quickſilver, and as much *aqua fortis*, let them be put together into a glaſs, and after the quickſilver is diſſolved, add to it five ounces of freſh water; warm it, and it will be fit to gild withall. *Or*,

TAKE one ounce of *aqua fortis*, put it into a matraſs, add to it a quarter of an ounce of mercury, let this diſſolve; then take freſh river water, and mix it with that in theg laſs, and make it luke-warm; then let it ſtand cloſe ſhut up, and you will have a good quickening water for gilding.

Another Water-gilding upon Silver.

TAKE copper-flakes, pour ſtrong vinegar thereon, add to it allum and ſalt, equal quantities of both, ſet them on a fire, and when the vinegar is boil'd to a fourth part, throw into it what metal you deſign to gild, and it will acquire a copper colour. If you continue boiling it, it will change into a fine gold colour. This is a fine ſecret for goldſmiths to gild ſilver, for the boiling it in that liquid, gives the guilding a high and rich colour.

A Water, which will give Silver a Gold Colour.

TAKE brimſtone and ſaltpetre, each an equal quantity; grind it together very fine, and put it into an unglaz'd veſſel, cover and lute it well; then ſet it over a ſlow fire for 24 hours, and what you find remaining, put into a ſtrong crucible, and let it diſſolve; then put it into a vial, and whatever ſilver you anoint therewith, it will give it a gold colour. *Or*,

TAKE ſulphur half a pound, ſaltpetre three quarters of a pound, mix both together, grind it fine, and proceed as above, or ſet it for 24 hours on hot aſhes; then take it out and grind it again. Of this powder take one third, mix it up with three quarterns of running water, mix it well, and you will have a red water like blood, which will tinge ſilver, copper, or braſs of a fine gold colour, after it has lain therein ten days.

A Method to work a Cup, one ſide Gold and the other Silver.

TAKE a piece of fine ſilver, form it into a flat ſquare, and file it rough all over on one ſide; raiſe alſo with a graver little points upon it. Then take a piece of gold in proportion to what thickneſs you would have it; form it exactly to the dimenſions of the ſilver, in a flat ſquare; neal both the gold and the ſilver red hot; then lay them quick on one another, and with a wooden hammer ſtrike them gently together: when thus you have united theſe two metals, you may make thereof what you pleaſe, one ſide will be ſilver and the other gold.

To adorn Gold, Silver, or Braſs, with Embelliſhments of Glaſs.

TAKE fine pulverized *Venice* glaſs, of what colour you pleaſe, grind it upon a ſtone, temper it with oil, then put it into a circle of clear charcoal fire to melt, it will look fine and beautiful, eſpecially if the ornaments are well deſign'd.

Of Heightening the Colour of GOLD and GILDED WORKS.

GOLD, as well as gilded ſilver, want conſiderably of that luſtre and brightneſs they appear in at goldſmiths ſhops; for before this, they undergo ſeveral operations, and are heightened by gilding-wax, colouring, and helling; each of which ſhall be ſeparately explain'd under the following heads.

Gilding Wax uſed for Gold, or gilded Work.

TAKE four ounces of clear wax, $\frac{3}{4}$ of an ounce of verditer, half an ounce of copper flakes, $\frac{1}{2}$ an ounce of red chalk, $\frac{1}{4}$ of an ounce of allum; melt the wax, and put the other things, finely powdered, into it, and ſtir it well together: let it cool and form thereof round ſticks like ſealing wax; When you have occaſion to make uſe of it, firſt heat your gold, and then rub it over with this wax; then neal it, and draw it nimbly through boiling hot water and tartar, and it will give the gold a deep colour.

To give Gold a high Colour.

TAKE clear wax one pound, crocus Veneris an ounce and a half, ſal-armoniac, fine terra-verd and allum, one ounce of each, red chalk half an ounce, 1 dram, crocus martis and tutia of each half an ounce, ſalt-petre or peter-ſalt, 2 drams, mix all theſe ingredients together, and after you have pulverized them, ſtir it and mix it well with melted wax, which being ſpread over the gilded work, and then neal'd, as has been obſerv'd before, it will give the gold a ſurprizing beauty. *Or,*

TAKE two pound of wax, one pound of red chalk, one pound of white vitriol, and four ounces of *Æs uſtum. Or,*

TAKE eight ounces of clear wax, one ounce and a half of *Terra Vert*, one ounce of *Æs uſtum*, one ounce of red chalk, and half an ounce of allum; diſſolve the wax, and put theſe ingredients into it; let it cool; then form it into ſticks like ſealing wax; with this, after you have heated your gilded metal, rub it over; then burn it off, and it will give the gold a deep colour.

Nurimberg Gilding Wax.

TAKE two pound of wax, two pound and one ounce of red chalk, one ounce of vitriol, half an ounce of *Æs uſtum*, three ounces of verdegreaſe, half an ounce of borax. *Or,*

TAKE four pound of clear wax, one pound eight ounces of red chalk, one pound eight ounces of white vitriol, 15 ounces of verdegreaſe, three ounces of *Venice* borax, 15 ounces of *Æs uſtum*, beat them fine, mix them together, and when the wax is melted, ſtir it till you perceive it to cool; then put in the ingredients, and ſtir them well together, and when cold, form them into ſticks like ſealing-wax.

To diſtinguiſh Silver from white Copper.

TAKE cinnaber, and ſulphur, mix'd together, ſtrew it upon the metal, light it, and when it burns you'll ſee whether it is copper or ſilver.

To make all Metals Mallable.

TAKE maſtick, franckincenſe, myrrh, borax of Venice, of each half an ounce, pulverize and mix them together, and when your metal is melted fling in it ſome of the powder, and you will be ſurpriſed at the effect thereof.

How to quicken Braſs for Gilding.

DISSOLVE ſal-armoniac in white-wine vinegar, and with it anoint your work, this will cauſe it to receive the mercury.

Of ſeveral GOLD COLOURS, whereby GOLD or GILDED WORK, after it has been heightened with GILDING-WAX, receives its proper Colour.

A Silver Gold Colour, or a Colour for gilded Silver.

TAKE one ounce of verdegreaſe, one ounce of ſaltpetre, one ounce of vitriol, half an ounce of ſal-armoniac, half an ounce of borax, grind them fine; boil them in half a pint of urine to half the quantity; then with a bruſh dipt in this liquid, bruſh over your gilded work; put it upon a clear charcoal fire, and when you ſee it turn black, take it off the fire, and quench it in urine.

A Green Gold Colour.

TAKE two ounces of ſalt-petre, two ounces of vitriol, two ounces of verdegreaſe, and one ounce of ſal-armoniac; mix and grind them with vinegar. *Or,*

TAKE four ounces of verdegreaſe, four ounces of ſal-armoniac, two ounces of vitriol, two ounces of *Æs uſtum*, one ounce of ſalt-petre, grind them with vinegar, and colour your gold therewith.

A French Gold Colour.

TAKE four ounces of ſalt, two ounces of alum, two ounces of ſal-armoniac, two ounces of *Æs uſtum*, one ounce of ſalt-petre, and grind them with vinegar. *Or,*

TAKE four ounces of ſal-armoniac, four ounces of verdegreaſe, two ounces of ſalt-petre, one ounce and an half of clean copper-flakes; grind them with vinegar.

A fine Gold Colour.

TAKE melted ſalt-petre, and black vitriol, an equal quantity of each, let them boil half away in a clean pipkin.

Another Gold Colour.

TAKE one ounce of verdegreaſe, one ounce of ſal-armoniac, one ounce of red chalk, one ounce of fine ſalt, grind all together, and boil them with vinegar. *Or,*

TAKE one ounce of ſalt-petre, one ounce of verdegreaſe, one ounce of vitriol, one ounce of ſal-armoniac, grind each ingredient ſeparately in a clean mortar; then mix and put them in a clean pan, with water, and boil them for almoſt half an hour.

A Green Gold Colour.

TAKE four ounces of ſal-armoniac, four ounces of verdegreaſe, two grains of ſalt-petre, and grind them in vinegar.

A White Colour for Gold.

TAKE two ounces of ſalt-petre, one ounce of allum, one ounce of ſalt; pulverize and mix them well together; then take a piece of a broken muffle or crucible, put it in the fire; and let it be red hot; wet the work you deſign to colour, and roll it in the powder; then put it on the red hot piece of the muffle, and the colour will boil up, when it melts, turn the piece of work with your tongs about; and when the colour is quite fluid and yellow, take it out, and lay it upon a clean brick or anvil till it is cold. Then take an unglaz'd pot, or elſe a large crucible; fill it almoſt up with clean water, put into it a handful of ſalt, and the quantity of a filbert of ground tartar; and ſix or eight drops of *aqua fortis*; let that boil; then put your work into it, and boil it till the droſs of the white colour is taken clean off, then ſcratch-bruſh it.

To colour an old Gold Chain, as tho' it were new.

TAKE urin, diſſolve therein ſal-armoniac, boil in this the gold chain, and it will have a fine colour.

A Green Colour for Gold Chains.

TAKE four ounces of ſal-armoniac, four ounces of verdegreaſe, one ounce and a half of ſalt-petre, half an ounce of white vitriol, make a powder thereof, mix it with vinegar, and boil your chain in it.

To give Gold a high and fine Colour.

TAKE red calcin'd vitriol three ounces, ſal-armoniac two ounces, and verdegreaſe one ounce: grind them together, and keep them dry. When you would colour your gold, moiſten it, and ſtrew this powder over it, neal it often, and quench it in pump-water.

Another fine Colour for Gold.

TAKE verdegreaſe, ſal-armoniac, ſalt-petre, and vitriol, an equal quantity of each, grind them well together; pour vinegar upon them, grind them again, as painters do their colours, and let them dry; then moiſten, grind, and dry them again; repeat this for ſeveral times: Then lay up your Powder carefully, and when you would colour gold, wet it with urine, rub it with a bruſh, then fling the powder upon it, lay it on red hot coals, and it will turn black, then quench it in urine, and rub it with a wire-bruſh; in this manner you may proceed with the other colours.

To bring pale Gold to a high Colour.

TAKE verdegreaſe, pour vinegar upon it, ſtir it well, anoint your gold therewith, heat it in the fire, and quench it in urin.

To make Silver yellow throughout, and to give it the Colour of Gold.

TAKE common *aqua fortis*, diſſolve therein as much ſilver as you pleaſe; if you have eight ounces, take four ounces of *hepatic aloes*, ſix ounces of *gurgumi*, two ounces of prepared tutty, that has been ſeveral times quench'd in urine; put theſe to the ſolution of the ſilver, and they will diſſolve, and riſe up in the glaſs like a ſpunge; the glaſs muſt be large, to prevent the running over; then draw it off, and you will have ten ounces of ſilver, which is as yellow as gold.

N.B. Theſe two ounces, increaſed in the weight of the ſilver, will not ſtand the teſt, but be loſt when melted down with lead.

A Water to give any Metal a Gold Colour.

TAKE fine ſulphur and pulverize it, then boil ſome ſtale ſpring or rain water, pour it hot upon the powder, and ſtir it well together; boil it and put into it one ounce of dragon's blood, and after it is well boil'd, take it off and filter it through a fine cloath: put this water into a matraſs, after you have put in what you deſign to colour; cloſe it well and boil it, and the metal will be of a fine gold colour.

Another

Another Water wherewith one may tinge any Metal of a Gold Colour; a curious Secret.

TAKE *hepatic aloes*, ſalt-petre, and *Roman* vitriol, each equal quantities, diſtil them with water in an alembic, till all the ſpirits are extracted; it will at laſt yield a yellowiſh water, which will tinge any ſort of metal of a gold colour.

To colour Gold.

TAKE a lock of human hair, of about a finger thick, lay it on live coals, and hold the gold with a pair of tongs over it, to receive the fumes thereof.

To give Gold a fine and high Colour.

TAKE one ounce of ſal-armoniac, two ounces of copper flakes, one ounce of diſtill'd verdegreaſe; grind all well together, put the mixture into a matraſs, pour upon it one quart of good diſtill'd white-wine vinegar; let it thus dry and boil away; then grind it fine, ſtrew it on a glaſs plate, and ſet it in a cellar, where it will turn into an oil: this is again to be gently coagulated, then ground and mix'd with ſublimate mercury; put half an ounce of it, wrapt up in bees wax, into the quantity of a pound of gold that is in fuſion, and it will give it a high and fine colour.

To give gilded-Work a fine Colour.

TAKE clean ſalt and brimſtone, boil them together with water in an egg-ſhell, after taking away the inſide film; take care you don't give too much fire to burn the egg-ſhell; with this liquid wipe over your gilding, and it will make it of a much brighter colour than it was before. *Or,*

TAKE powder of ſulphur, and bruiſed garlick, boil theſe in urine, neal your gold, quench it threin, and it will give it a fine colour.

To

To brighten Spots in Gilding.

TAKE allum, boil it in clear water, put your work into it; this will reſtore the colour again, and remove the ſpots.

To give old Silver Lace or Trimmings their Beauty and Colour, as if they were new.

TAKE powder of alabaſter, put it dry into a pipkin, and let it boil as long as it can; then take it off the fire, and when cold, lay your lace upon a cloth, and with a comb-bruſh, take up ſome of that powder, and rub therewith both ſides, till it is as bright as you would have it, after wards poliſh it with a ſmooth ſtone. *Or,*

TAKE ox-gall, and the gall of a large jack, and ſome water, mix it together, and with it rub your gold or ſilver, and you will ſee the colour change to your liking.

Of the HELL, or HELLING of GOLD.

This is the finiſhing ſtroke of either gold or gilded work, and is perform'd after it has undergone the operations with the gilding-wax and gold colours as has been ſhewn in the foregoing articles. The following are the different receipts of different maſters. The ingenious and judicious will by experience ſoon diſcover which of them is beſt, and make his choice of ſuch as he approves.

To Hell Gold, or gilded Work.

TAKE two ounces of tartar, two ounces of ſulphur and four ounces of ſalt; boil this in half water, and half urine, dip your gold or gilded work into it, and it will give it a fine luſtre. *Or,* TAKE eight ounces of ſalt, two ounces of tartar, two ounces of ſulphur, two ounces of *Cap. Mort.* half an ounce of allum; if you boil this in water and urine, and draw your work through, it will anſwer your expectation: *Or,*

TAKE eight ounces of ſulphur, eight ounces of allum, eight ounce of yellow arſenick, 16 ounces of tartar, 16 ounces of ſalt; boil them in water and urine. *Or,*

TAKE three ounces of ſulphur, one ounce of allum, one ounce of arſenick, half an ounce of *Gurgumi,* and half a grain of antimony, grind them very fine together; then boil them in urine and water, and ſtir the ingredients gently together; boil the mixture a little, put the gilded plate into it, and boil it till the colour is bright. *Or,*

TAKE eight ounces of yellow arſenick, 16 ounces of ſulphur, 16 ounces of tartar, 16 ounces of burnt allum, three ounces and a half of ſalt: boil the mixture in urine and water. *Or,*

TAKE ſifted aſhes and antimony finely pulveriz'd, with theſe make a lee, and with a bruſh rub over the gilded ſilver. *Or,*

TAKE one ounce of white tartar, one ounce of green ſulphur, nine ounces of ſalt; grind them together like flower; then take a copper ſauce-pan with freſh water, and let the water boil; put into it one grain of crude yellow arſenick; take of the ground ingredients three ſpoonfuls, and let it boil; after that, you may draw your work through it and make it as high as you will, and it will come out clear and with a fine luſtre.

How to take off the Gold from gilded Silver Tankards or Cups.

TO take off the gold from ſuch plate, take ſal-armoniac one part, ſalt-petre a half part, grind them both to a powder, wipe over the gilded part with oil, ſtrew the powder upon it, and lay your plate into the fire to heat it well; then take it out; hold your plate over an earthen diſh, in one hand, and with the other beat it with an iron, and the powder will fall into the diſh, together with the gold, which you may ſeparate in the manner as has been directed.

Another Method.

PUT quickſilver in an earthen diſh, heat it lukewarm; in this turn your ſilver cup or other utenſil, and the gold will ſeparate from the ſilver, and join the quickſilver; when you ſee the gold all come off the plate, take it out, pour the quickſilver with the gold, after it is cold, into another diſh and if any place ſtill retains ſome gold, repeat it, till you perceive no more upon it; then ſtrain the quickſilver thro' a leather; what remains put into a retort*, and on hot ſand or aſhes force the reſt of the mercury from it into a receiver with water, and what is left melt together, and refine the gold as has been taught before.

An approved Method to take off the Gilding from Silver.

FIRST take a glaſs or a glazed utenſil, with aqua fortis, the quantity whereof muſt be according to the bigneſs of your work; take no more than half $\frac{1}{4}$ of an ounce of ſal-armoniac to one ounce of aqua fortis; beat your ſal-armoniac fine; put it into the aqua fortis, and ſet it over the fire, till it grows warm; and when you perceive the ſal-armoniac to work, then put in the gilded ſilver, and when you obſerve your work to become of a black colour, then the gold is taken off of it; if there is a pretty large quantity of work, let it lie for half an hour or an hour before you take it out, which you muſt do with a pair of wooden plyers; when it is taken out, put it into clean water, then neal it, and afterwards boil it with tartar, repeat this for three times ſucceſſively, and your ſilver will look freſh and new.

How

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* *Vid. Plate* II. *fig.* 6. The neck, through which the mercury is convey'd, muſt be half way in the water, that is in the receiver.

How to get the Gold out of Aqua Fortis.

TAKE a copper bowl or cup, put into it a glaſs full of water, then pour in the aqua fortis which contains gold in order to ſweeten it a little; then add to it $\frac{1}{4}$ of an ounce of *Venice* borax, and boil it up; let it ſtand all night, in the morning pour it off gently, and the gold will be ſettled at the bottom: dry it by degrees, and when dry, put a little borax to it and melt it.

To give Silver Utenſils a Luſtre.

DIſſolve allum in a ſtrong lee, ſcum it carefully; then mix it up with ſoap and waſh your ſilver utenſils therewith, with a linnen rag.

To ſeparate Gold from gilded Silver, by Cementation.

TAKE red calcined * vitriol or *Colcothar* one part, ſalt one part, alſo red lead half a part, pulverize and mix them all well together; with this mixed powder cover your gilded ſilver all over in an earthen pan, put it into a furnace, and give it a ſlow fire, to prevent the melting of the ſilver: the powder will attract the gold, which you may reduce by melting it with lead, and by ſeparating it in the coppel.

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* The calcination of vitriol is perform'd thus: Put what quantity you pleaſe of green vitriol into an earthen pot, unglazed; ſet the pot over the fire and the vitriol will diſſolve into water; boil it till the moiſture is conſumed, or the matter turns into a grayiſh maſs, drawing towards white; this is called white calcined vitriol. If you calcine this white vitriol a good while over a ſtrong fire, it will turn as red as blood. This is call'd *Colcothar.*

Of ſeveral Sorts of SOLDER for GOLD and SILVER.

Filings-Solder for Silver Chain-Work.

MELT three parts of fine ſilver and one part of braſs; when in fuſion, fling into it a little quantity of yellow arſenick. *Or*,

TAKE one part yellow arſenick, and one part of copper, melt and granulize it; of this take one part, and of fine ſilver four parts; melt them together; caſt them into an ingot, and when cold file it to a fine duſt.

A Solder for Silver.

MELT two parts of ſilver, then put to it one part of thin beaten braſs or tincel; but don't keep it too long in fuſion, leaſt the braſs ſhould fly away in fumes.

Another, for coarſe Silver.

FOUR ounces of ſilver; three ounces of braſs, $\frac{1}{4}$ of an ounce of arſenick, melt them together, and pour them out quick.

Another Silver Solder.

MELT two ounces of ſilver, one ounce of tincel, add to it half an ounce of white arſenic, pour it out quick, and it is a very good ſolder. *Or*,

MELT one ounce of fine ſilver, one ounce of thin braſs; when both are well melted together, then fling one ounce of white arſenic upon it, let it melt, ſtir it well together, and pour it out quickly.

A good Solder for Gold.

MELT copper and fine ſilver, of each one part, fine gold two parts. *Or*, TAKE one penny-weight of the ſame gold your work is of, and allay it with three grains of copper, and three grains of ſilver.

The Manner and Way of Soldering GOLD or SILVER.

BEAT the ſolder thin, and cut it into little bits, or pallions; then take the work which is to be ſoldered, join it together with fine wire, wet the joinings with a pencil with water, mix'd up with borax; then lay the bits or pallions of ſolder upon it, and ſtrew ſome powdered borax over; lay the work, if it be a button or ſome other ſmall thing, upon a large coal, and blow with your blowing inſtrument, through a large lamp flame upon it, for to melt it.

After this boil the work either in allum-water, or elſe in *aqua fortis*, to clear it from the borax, and dry it on a charcoal fire; then file or turn it; if it be ſilver, boil it white in the following manner.

Take the work, lay it on a clear fire, and when red hot, take it out, and put it by to cool; in the mean while ſet a copper-pan not tinn'd, with water upon the fire, into whch put one part of fine ſalt, and one part of tartar; this boil together, yet not too fiercely, to prevent it's boiling over; after it is well boiled, lay the work when it is a little cold, into it, and let it boil about ſix minutes; then take it off the fire, take out the work, and put it immediately into clean water, take it out and ſcratch it well with a wire bruſh, to clear it of the coat; then repeat this work over again; neal it once more, boil it in tartar and ſalt, and proceed as before; then take black burnt tartar, mix it with a little water into a paſte, with which rub over the work; then neal it on a clear coal fire; take it out, and bruſh the work well of the burnt tartar in clean water; put it once more in the tartar-water in which it was boiled, and let it boil four minutes then waſh it in cold water, and dry it with a clean rag, it will be of a white and beautiful pearl colour.

To ſolder a Ring ſet with Stones.

TAKE a large charcoal, put two or three penny weights of ſilver upon it, melt it with your blowing inſtrument and the lamp; then after you have clap'd a thin pallion of ſilver ſolder betwixt the opening of the ring, dip it into it; but as ſoon as you ſee the pallion run, take off your ring, or elſe the ſilver will devour it.

Borax *for Soldering.*

TAKE the beſt hard *Venice* ſoap, ſcrape it as thin as poſſible, let it dry between two papers in the air; then rub it to a powder, put it into an unglaz'd pipkin, ſet it on a gentle coal fire, and let it by degrees fumigate, till it has no moiſture at all, then it is right; this borax you may uſe for all manner of work, and it will do better than the *Venice* borax.

To melt in a Moment ſeveral Sorts of Metals, over a Table.

TAKE two ounces of ſalt-petre, tartar one ounce, ſulphur half an ounce, beat it in a mortar to a powder; then take one ounce of filed metal, or fine pulverized oar, mix it well together, put it into a ſmall crucible, or a hollowed charcoal, light it with a little ſplinter, and it will melt immediately.

Another Manner of doing it.

TAKE one ounce of ſalt-petre, half an ounce of ſulphur, $\frac{1}{4}$ of an ounce of gun-powder; grind them well together and put half of this powder into a ſmall crucible, or if you will, into an egg-ſhell, then put a farthing or ſix-pence, or any other metal upon it, and upon that, put the other half of the powder, preſs it down with your finger, then ſet it on a ſtone, light it, and it will melt immediately.

N. B. A glided cup, or other plate, if anointed with ſallet oil, and this powder flung upon and lighted, takes off the gold, and melts it to a maſs.

To prepare Aurum Fulminans.

TAKE gold that's refin'd with antimony, beat it into thin plates, put it into a phial or matraſs, pour *aqua regis* upon it; then ſet the phial or matraſs upon a ſand-heat till the *aqua regis* has diſſolv'd as much of the gold as it is able to contain, which you will know when you ſee the ebullition ceaſe; pour your ſolution by inclination into another glaſs, and if you obſerve any gold remain in the matraſs, diſſolve it as before with a little freſh *aqua regis*; mix your diſſolution, and pour on it ſix times as much common water; afterwards drop into this mixture, by degrees, the volatile ſpirit of ſal-armoniac, or oil of tartar, and you will ſee the gold precipitate to the bottom of the glaſs; let it reſt a good while for the gold to ſettle, then pour off the water by inclination, waſh your powder with warm water, till it grows inſipid, dry it to the conſiſtence of a paſte, then form it into little round corns, the bigneſs of hemp-ſeed, dry them by the ſun; if you put one of them into the fire it will fly about with a terrible noiſe, and great violence.

To make Aurum Sophiſticum, or mimick Gold.

TAKE fine diſtill'd verdegreaſe eight ounces, crude *Alexandrian* tutty four ounces, borax twelve ounces, ſalt-petre one ounce and a half, pulverize and mix them all together, temper them with oil, with a wooden ſpatula, to the conſiſtence of a paſte, then put a *German* crucible into a wind-furnace, heat it red hot, and convey your maſs into it with a wooden ſpatula; by little and little; when all is in, cover it; fill your furnace with coals all over the crucible; let it ſtand in a fierce fire and melt; let it cool of itſelf; then break the crucible, and you will find at the bottom a fine *Regulus* like gold, weighing about four ounces, out of which you may form and make what you pleaſe, it will be as malleable as real gold.

Another.

TAKE fine and clear wire-copper four ounces; melt it; then fling into it one ounce of *Speltar*, ſtir it well together with an iron ſpatula; blow the fire briſk, to bring it into fuſion, but before you pour it out, put in ſome borax and it will give it a peculiar beauty: Then caſt it into an ingot; out of this ingot you may draw wire for chains, and work it in what form or ſhape you pleaſe, and after you have filed it, and rubb'd your work well with tripoly, then give it the finiſhing with a mixture of one grain of tripoly, and ſix grains of flower of ſulphur, which put upon a piece of leather, rub your work as uſual, and it will have a fine gold colour.

Another.

TAKE *Speltar* one ounce, of the fineſt and ſofteſt copper two ounces; melt the copper in a crucible; when melted, fling into it *Venice* borax two grains, and ſal-armoniac two grains, and laſtly fling in the *Speltar*: pour it into an ingot, and you will have a fine gold colour'd metal.

To make a curious yellow mix'd Metal reſembling Gold, and which may be drawn into fine Wire.

TAKE eight ounces of tartar, put it into a crucible and neal it by degrees; then take pulverized dry ſalt-petre, and fling on the red hot tartar, and it well melt into a yellow maſs; take it from the fire, let it cool, then take clean copper, put it into fuſion till it is like fair water, and fling to eight ounces of copper the above maſs; give the crucible a ſtrong reverberatory heat, till in fuſion, then take the beſt *Speltar* or *Goſslar Zink* half an ounce, *Tutty* and *Venice Salacani* half an ounce, put it to the melted copper, and preſently you will hear a crackling noiſe, and ſee a yellow fume and flame aſcend; ſtir this copper and the other ingredients well together with an iron wire till it is burnt away, let it ſtand a little in the flux, and then after you have rubbed your ingot with wax, pour it in, and it will be ſo plyable as to be drawn into wire, and of a high gold colour; you may work, form, finiſh, and colour it as you do other gold.

To convert Copper into Braſs.

TAKE of Copper what Quantity you pleaſe, add to it a third part of powder'd *Lapis Calaminaris*, put it together in a melting pot, and let it be in fuſion for about an hour, then pour it out.

Another Method to make a Metal reſembling Gold.

TAKE fine copper filings one pound, fine ſalt-petre eight ounces, prepared *Tutty* ſix ounces, borax ſix ounces, *Hepatic Aloes* four ounces; mix all well together, and incorporate the mixture with linſeed oil into a maſs; put it into a clean crucible, and cover it a-top, a finger's height, with ſubtil pulverized *Venice* glaſs; lute it well; put it into a wind-furnace; fill the ſame with dead coals, then put live coals upon them, and light the fire from the top to go down-wards; blow it for an hour, and give it a fierce fire; then let it cool of itſelf; take out the crucible, break the ſame, and you will find at the bottom a very fine *Regulus* like gold; this melt again, and add to one pound two ounces of *Mercury Sublimate*, and two ounces of prepared *Tutty*, both clap'd up in red ſealing-wax; ſtir it well with a dry ſtick; then caſt it into a mould, and make of it what you pleaſe. *Or*,

TAKE ſix ounces of diſtill'd verdegreaſe, grind it fine in a marble mortar beat eight ounces of prepared *Tutty*, four ounces of ſalt-petre, four ounces of borax into a coarſe powder: Moiſten them with oil of turneps, and ſtir them in an earthen diſh all together, till all is well mix'd: Then put a crucible into a wind-furnace, and when red hot, convey the ſaid mixture into it with a wooden ſpatula; cover it, add more coals, and give a brisk and ſtrong fire, all over the crucible. In about half an hour, put a little ſtick into it, and try whether the matter be diſſolv'd, and in fuſion like water; if ſo, then it is time to pour it out; but if you find ſtill ſome matter remain, ſtir it about with your ſtick; cover it, and give it a brisk fire, till you find it is all diſſolv'd: Then pour it out, into a mortar or braſs cone, and you will have a fine gold colour'd regulus.

To ſilver Copper or Braſs.

TAKE fine ſilver one ounce, ſal-gemmæ and ſal-armoniac of each ſix ounces, glaſs-gall ſix ounces; beat the ſilver thin, and then put it into one ounce of aqua-fortis, let it diſſolve; when diſſolved, fling a little ſalt into it, and the ſilver will ſettle like a white calx at the bottom; then pour off that water, and put on freſh; repeat it, till the ſilver calx has loſt all the flavour of the *aqua-fortis*; dry this ſilver calx; then take the above ingredients and grind them well on a clean ſtone; when you have well ground them, mix and grind them and the ſilver calx together, with a little water, till the mixture is like a thick paſte; put this up in a clean glaſs; and when you would ſilver, take care that your metal be filed and bruſh'd clean; rub it over with the above matter, and lay it on live coals; when it has done ſmoaking ſcratch it well, and rub it over again with the ſilver-matter; do this three times ſucceſſively, and you will have a fine ſilvering.

Another Way.

TAKE fine ſilver, diſſolve it in *aqua-fortis*; then add to it the ſame quantity of warm water, as you had done of *aqua-fortis*: Take common ſalt, fling it into the mixt waters, and the ſilver will precipitate to the bottom like a powder; when ſettled, pour off the mixt water, and ſweeten the ſilver calx, by pouring freſh water to it, ſhifting it till all the ſharpneſs is removed. Then drain off the water, and let the ſilver dry, of which take $\frac{1}{4}$ of an ounce, white calcined tartar one ounce, common ſalt half an ounce; then beat and mix them well together, and with *aqua-fortis* grind them upon a ſtone; then let them dry, and you have a powder ready to ſilver withal. If you would ſilver either poor ſilver, copper, or braſs, then rub the powder well in after you have moiſtened it with water, with a piece of cork to your mind; then lay it on a coal fire, till it is red hot; let it cool; then boil it in water with tartar and ſalt, and after it is boiled, waſh it in clean water.

What Metals are moſt proper to incorporate with Silver.

SILVER will eaſily mix and incorporate with fine clean copper, of each an equal Quantity, for if you add more copper than ſilver to your compoſition, it looſes the whiteneſs, and is not fit for to make any utenſils therewith. All other metals are of a contrary nature to ſilver, as lead, tin, iron, braſs, &c. wherefore they are to be avoided.

To ſilver Braſs in Fire

TAKE calx of fine ſilver half an ounce, one ounce of ſal-armoniac, three ounces of ſalt; mix and grind theſe well together. When you uſe it, grind and temper it together with water, and rub your braſs therewith; neal it brown; then quench it in water, wherein tartar has been diſſolv'd; ſcratch it, and finiſh your work by poliſhing it, as you ſee requiſite.

A Powder to ſilver Copper or Braſs withal, by rubbing it with one's Finger.

DISSOLVE a little ſilver in *aqua-fortis*, add to it as much tartar and ſal-armoniac as to make it like a paſte, whereof make little balls; dry and pulverize them: If you take ſome of this powder on your wetted thumb, and rub it upon the copper or braſs, it will give it the colour of ſilver.

A ſilvering on Copper.

DISSOLVE fine ſilver in *aqua-fortis*; pour it upon pulveriz'd tartar, and then draw your *aqua-fortis* clear off, and there remains a black matter; with this rub your copper; then neal it well and boil it in tartar and ſalt.

To ſilver Copper or Braſs with boiling it,

TAKE three ounces of ſalt, 26 leaves of ſilver, $\frac{1}{4}$ of an ounce of tartar, half an ounce of alom; boil this in an earthen pipkin, and ſtir it well together; put what you deſign to ſilver into it; pour water upon it, and let it boil; after it is well boil'd, ſcratch-bruſh it; put it in again and boil it; then ſcratch it again, and repeat this ſo often, till it is to your mind.

To boil Braſs like Silver.

TAKE one part of the filings of good pewter; add to it one part of white tartar, and mix it together; then take an unglazed pipkin, put theſe two ingredients, and the braſs (which before muſt be well ſcratch'd and clean'd) into it, and let it boil.

To ſilver Copper, Braſs, Steel, or Iron, ſo as not to come off, except it is made red hot.

TAKE urine which is made in the morning, cover it and let it ſtand a whole month, and it will ferment; put it into a kettle or earthen pot, and let it boil; skim it, and when the third part is evaporated, take to two pints of urine one ounce of tartar, and one ounce of galiz-ſtone; put it in, and let it boil once up. This liquid keep clean, and if you would ſilver any metal, take brick-duſt on a wet woolen rag, and rub therewith your iron or other metal, till it is clear and fine, and put it 24 hours in the prepared urine; afterwards dry it, and where you deſign to ſilver, rub it over with quick-ſilver; you muſt lay it on thin with an iron ſpatula that has alſo lain two hours in the urine; then rub it on with a ſoft woolen rag, and it is a fine bright ſilvering.

To ſilver all Sorts of Metals.

TAKE as much *aqua-fortis* as you think there is occaſion for, put it in a glaſs, and ſet it on hot aſhes; then put in your quantity of ſilver, which firſt has been beaten very thin, and cut into little ſhreds. When your ſilver is diſſolved, take it off the aſhes, and mix that liquid with as much white tartar as will make it like a paſte; If you rub braſs, copper, or any other metal over with this, it will be like ſilver itſelf.

PART II.

Choice Secrets for JEWELLERS, in ENAMELLING and the preparing of ENAMEL-COLOURS; the Art of Painting on enamel'd PLATES. Several curious Inſtructions how to make Artificial PEARLS; of DOUBLETS and FOYLES; and how to prepare and colour them. The Art of counterfeiting precious STONES, together with other rare Secrets.

THE foregoing part will, no doubt, give a ſufficient idea, and direct the ingenious reader in the management of gold and ſilver, in all the different branches ſpecify'd. We ſhall in this ſecond part preſent him with ſeveral choice ſecrets, peculiarly relating to Jewellers, and firſt ſhew that admirable branch.

OF ENAMELLING.

To prepare the Flux for Enamel Colours.

TAKE four ounces of red lead, one ounce of well waſh'd and clean'd ſea ſand; melt them together, and put them in a cold ingot. *Or*,

Take pebble one part, prepared as ſhall be directed; mix one part thereof with five parts of red lead

Another Sort of Flux, which is very ſoft.

TAKE one ounce of white lead, $\frac{1}{4}$ of an ounce of red lead, 12 grains of pebble; beat the pebbles red hot, and quench them in urine; repeat this, till you can crumble them to an impalpable powder between your fingers; then beat them fine, put them with the ingredients into a clean crucible; lute it well, and when dry, give it a fierce fire for half an hour, or longer; than take it off the fire, and let it cool of itſelf; break the crucible afterwards, and you will find a regulus; which melt again in another clean crucible, and pour it into a clean ingot, or a bright braſs weight ſcale, and then it will be fit for uſe; beating and grinding it in an agat mortar, to an impalpable powder. When you mix your colours therewith, temper as much as you have occaſion for, with oil of ſpike.

A Green Colour.

TAKE of copperas, after nealing it, one part, four parts of flux. *Or*,

Take braſs, and diſſolve it in *aqua fortis*, then neal it well, take of this one part, and three parts of flux. *Or*,

TAKE copper plates, and with a piece of pumice-ſtone rub it over with water, receive the water into a baſon or diſh, till you have wore it off pretty thin, then let it ſettle; pour off the water, and neal the ſettling; then take thereof one part, and three parts of flux; and this makes a good and fine green.

Dark Green.

TAKE green enamel two parts, yellow ſmalt one eighth part, and ſix parts of verditer.

Yellow Colour.

TAKE fine king's yellow, neal it in a crucible, one part yellow, and three parts flux.

A high Yellow.

TAKE gold-yellow enamel, vitriol and flux; grind and temper them to your mind with oil of ſpike.

Brimſtone

Brimſtone Colour.

TAKE calcined *Naples* yellow one part, three parts of burn'd lead yellow, and three parts of flux.

A Black Colour.

TAKE ¾ of black enamel, and one eighth of ſcales of iron of an enamel-plate; grind this with water in an agat mortar very fine; draw the water from it, and dry it upon hot plates; then grind it with oil of ſpike. *Or,*

TAKE *Hungarian* vitriol, boil it over a gentle fire, take borax, and melt it in a new crucible, three different times; take one part of vitriol, three parts of flux; grind theſe with oil of ſpike as quick as poſſible. *Or,*

TAKE magneſia, neal it upon a tile; the blacker it comes off the fire the better; and take one part thereof with three parts of flux, ground with oil of ſpike.

A good Red.

TAKE *Hungarian* vitriol; grind it fine, and dry it in the ſun, then neal it between two crucibles, well luted, ſo as to prevent the air's coming to it. Take thereof one part, and two parts and a half of flux; melt them together, and when you uſe them, grind them with oil of ſpike.

Another.

TAKE *Roman* vitriol, about the quantity of a walnut; grind it in a ſtone mortar very fine; dry it, and then neal it to a brown colour; take the heavy lumps, put them into a new glazed pipkin, and pour *aqua fortis* upon them; then waſh the *aqua fortis* from them again, and let it evaporate; take afterwards one part thereof, and three parts of flux; grind it with oil of ſpike.

Another good Red.

TAKE brown red, or caput mortuum of *aqua fortis*, or *Paris* red, and a little flux; grind them fine with oil of ſpike, *Or*,

TAKE vitriol, let it boil up in a clean crucible, and when dry, pour a little *aqua fortis* and vinegar on it; neal it well; after that waſh it with clean water, till it has no taſte; dry it over a fire; and when dry, neal it again; then take of this one part, and three parts of flux.

Blue Colours.

TAKE fine ſmalt, waſh it well with clear water, as fine as poſſible; put a little flux to it, and grind it with oil of ſpike. *Or*,

TAKE ultramarine one part, flux four parts; grind them with oil of ſpike. *Or*,

SIX ounces of lead, four ounces of ſand, two ounces of ſaffera, two quarts of pot-aſhes, and two quarts of lead-ſalt.

Smalt may alſo be uſed without the principal powder, only ground with oil of ſpike.

Green.

TAKE verditer, and a little ground flux; grind them with oil of ſpike.

Graſs Green.

TAKE verditer, neal it in a crucible, and take one part of it and three and a half of flux.

Brown Colours.

TAKE crocus martis one part, flux two parts, grind them with oil of ſpike.

Purple Colour.

TAKE one part crocus martis, one part ſmalt, and three parts flux. *Or,*

TAKE blood-ſtone, grind it with vinegar; when it is fine, waſh it clean, and burn it over a candle on a thin plate.

Hair Colour.

TAKE umber, neal it in a crucible; then take one part thereof, and three parts of flux; grind them with oil of ſpike.

Fawn Colour.

TAKE vitriol, glow it as hot as poſſibly you can; then take of it one part, and three parts flux.

Carnation Colour.

TAKE yellow oker, glow it in a crucible very hot, and after that let it cool, and beat it in an iron mortar, and if it is not of a fine colour, neal it again; take of this one part, and three and a half of flux.

A Steel Red for Enamel.

TAKE fine thin beaten plates of ſteel, cut them into ſmall ſhreads; put them into a viol with *aqua fortis*, and when reduced to a calx over a ſlow fire, then neal it; of this take one part, and three parts of flux.

Of the ART of PAINTING on ENAMEL.

THE ancients that laboured in this noble art, were unacquainted with the beauties the moderns have diſcovered, particularly in the art of compounding colours for repreſenting portraitures and hiſtory; the fine performances in thoſe particulars are the admiration of every curious beholder: Beſides their peculiar beauty and luſture, they have the pre-eminence to all other paintings, in that they are not ſubject to the injury of the air or weather, as moſt other paintings, either in oil or water-colours are; and unleſs they are rubbed or ſcratched with any thing harder than themſelves, the colours will retain their beauty forever, and be as fine and bright as when firſt done.

This curious art cannot be effected without fire, which always muſtbe reverberatory, or in a furnace, ſo artfully contrived that the fire may play all over the muffle that covers your work; but to explain this more fully: take the half of a large crucible, *viz.* one that is ſplit down lengthways, but as thin as poſſible you can get; when your reverberatory is building, let the mouth part of the crucible, the ſplit ſide downwards, be placed fronting the mouth of the furnace, and be fixed in ſuch a manner, that the furnace fire may not play into it, nor the aſhes drop upon your work.

Your furnace may be either round or ſquare; it may be of iron or earth, no matter which; only let there be ſo much room in the inſide as will contain the ſplit crucible or muffle, with a good charcoal fire round about, to cover it; You muſt have a ſlice or iron plate to put your work upon, which, with a pair of tongs, you convey into the furnace, and bring out again.

The metals fitteſt to enamel upon are gold, ſilver, and copper; but the beſt work is performed on gold, for ſilver makes the white enamel appear of a yellowiſh hue; and copper is apt to ſcale, whereby the enamel is ſubject to break in pieces; beſides the colours loſe a great deal of their charms and luſture to what they appear upon gold. And the gold uſed for this purpoſe, ſhould be the fineſt, elſe the impurities of a bad allay will have the ſame effect in the enamel colours as the ſilver or copper.

Your plate, of whatever metal it be, muſt be very thin, raiſed in the nature of a convex; both that and the concave ſide are laid over with white enamel; that on the convex ſide, whereon your paint muſt be lay'd on a ſmall matter thicker than the other. You muſt obſerve that the white enamel which you lay on the convex, be ground with fair water in an agat mortar, and with an agat peſtle till it be fit for uſe: The enamel for the other ſide muſt be tempered with water wherein you have before ſteep'd ſome quince-kernels.

As to the enamel-colours which you paint with, you muſt take great care that they be equally tempered or your work will be ſpoil'd; if one be ſofter than the other, when your work comes into the furnace and grows hot, the ſoft colour will intermix with the hard, ſo as to deface your work intirely: this may ſerve to caution you to make tryal upon a white enamel'd plate, for that purpoſe, of all your enamels, before you begin your work; experience will direct you further.

Take particular care that not the leaſt dirt imaginable come to your colours while you are either painting or grinding them; for the leaſt ſpeck thereof, when it is work'd up with it, and when the work comes to be put into the reverberatory to be red hot, will leave a hole, and ſo deface your work.

After you have prepared your plate with a white enamel, and it is ready to paint upon, apply your colours on an ivory pallat or a piece of glaſs in a juſt order, as in limning, and firſt deliniate your deſign with a dark red, made of caput mortuum or crocus martis, ground with oil of ſpike; put the piece in the muffle, and with a reverberatory fire, as before directed, fix that colour; and then proceed to painting, remembring to dilute the thick and opaque enamel colours with oil of ſpike; and the tranſparent ones with fair water; by mixing blew and yellow enamel colour you have a fair green; blew and red, a violet; red and white, a roſe colour; and ſo of other colours.

We ſhall here ſet down ſeveral other receipts for preparing enamel colours to the greateſt perfection, which will not only be fit in beautifying and adorning of gold: but alſo for portraiture or painting on enamel.

To prepare the principal Matter for Enamel Colours.

TAKE lead 15 pound, plate-tin aſhes 16 pound; mix and calcine theſe as directed in the firſt part, after you have calcined your lead and tin, ſearce the calx, and put it into an earthen pot fill'd with water; ſet it over a fire, and let it boil a little, after which take it off, pour the water into another veſſel, which will carry the more ſubtil calx along with it: repeat this till you can ſubtilize no more of the calx, and the water comes off clean without any mixture. What groſs part remains in the pot, calcine as before, and this repeat till you can draw off no more of the ſubtil matter. Then pour the water from all your receivers into one that is larger, and evaporate it on a ſlow fire, leaſt by a fierce one the calx ſhould founder or ſettle to the bottom, but continue more fine and ſubtil than when firſt calcined.

Of this calx take 12 pound, frit of white ſand beaten and ſearced 12 pound, ſalt-petre purified 12 pound, ſalt of tartar purified * and ſearced two ounces. Put theſe powders all together into a pot, place it in a glaſs-houſe-furnace for ten or twelve

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* To purify ſalt of tartar, calcine tartar of red wine in an earthen pot, till it comes black; continue the fire till it changes to a white. Then put it into an earthen pan, glaz'd; fill the pan with clear water, and boil it over a gentle fire, ſo that in four hours the water may evaporate the fourth part; then take it off the fire, and after the water is ſettled and cold, pour it off by inclination, into a clean glaz'd pan, and you will have a ſtrong lee. Then pour clean water on the fœces, and let them boil as before: this repeat, till the water becomes inſipid: then filter the lees; put them in glaſs bodies upon the aſhes in a gentle heat to evaporate, and at the bottom there will remain a very white ſalt. Diſſolve this ſalt again in fair water, and let it ſtand two days, for the fœces to ſettle; then filter it, and evaporate it at a gentle fire as before, and you will have a ſalt whiter than the former; repeat this three or four times, and your ſalt will be whiter than ſnow itſelf.

12 hours to digeſt and purify. Then take and reduce it t an impalpable powder; keep it in a cloſe dry place for uſe Thus is your firſt or principal matter for enamel colours prepared.

To make Enamel of a milk white Colour:

TAKE three pound of the fore-mentioned principa powder, and 24 grains of magneſia prepared *, arſenick two pound, put theſe together into a melting pot to mel and purify over a fierce fire: when the matter is thus melted throw it out of the pot into fair water, and having afterward dry'd it, melt it again as before; do this for the third time changing the water; when you have thus purified it, an found the white colour anſwer your intent, it is well; bu in caſe it has ſtill a tincture of a greeniſh hue, add a littl more magneſia, and in melting it over again it will becom as white as milk, and be fit to enamel with upon gold or othe metals: take it off the fire, make it into cakes, and preſerv it for uſe.

A Turcoiſe blue Enamel.

TAKE of the principal matter or powder three pound melt and purify it in a white glaz'd pot, then caſt i into water; when dry, put it again into a pot, and being melted over again, add to it at four times this compoſition: ſcale of copper thrice calcined † two ounces and a half, prepare zaffer 43 grains, of prepared magneſia 24 grains, ſtone-blu tw two ounces; mix and reduce theſe to a very fine powder; ſtir the matter very well with an iron rod, for the powders to incorporate. When your matter is thus ting'd, obſerve well whether your colour anſwers your intention before you empty the pot: if you perceive the tinging-powders are too predominant, add more of the principal powders; and if too faint, add more of the tinging-powders. Your own judgment muſt direct you in the management of this preparation.

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* The preparation of the magneſia is thus; put ſome pieces in a iron ladle into a reverberatory fire; and when it begins to white ſprinkle it with good vinegar, after which heat it, and waſh. whilſt hot; then dry it, and reduce it into a powder.

† To calcine copper ſcales, ſuch as come from the hammer of braſiers or copper ſmiths: waſh them from their foulneſs, put the into a crucible, place it in the mouth of a reverberatory furnace f four days; after which let them cool, then pound, grind an ſearce them. This powder put a ſecond time into the furnace reverberate four days longer; proceed as before, and after it h ſtood again the third time for four days, reduce it into powde and it will be fit for the uſe deſign'd for.

A fine blew Enamel

TAKE two pound of the principal powder, purified, one ounce of prepared zaffer, or of indigo-blue; 22 grains of copper thrice calcin'd; mix and reduce theſe to a fine powder, put them into a white glaz'd pot: When the metal is melted, caſt it into water; then dry it, and put it into the pot again: let it ſtand upon the fire, till it is well incorporated: Take it off, make it into cakes, and keep it for uſe.

A Green Enamel.

TAKE two pound of the principal powder, purified, one ounce of copper ſcales thrice refin'd, 24 grains of ſcales of iron, copperas two ounces, yellow arſenick one ounce; mix and reduce theſe to an impalpable powder, and at three ſeveral times, or in three ſeveral portions, fling it into the principal matter, ſtirring the metal ſo as to tinge it equally. When the colour is to your liking, let it ſtand for a while in the fire, to incorporate thoroughly; then take it off, and you will have a delicate green. *Or,*

TAKE * feretto of *Spain* two ounces, 48 grains of crocus martis prepar'd with vinegar, yellow arſenick two ounces; pulverize and mix theſe well, and put them into

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* Feretto of *Spain* is thus prepared: Stratify thin plates of copper with vitriol, in a crucible; put it in the mouth of a glaſs furnace, for three days; then take it out, and add to the copper new rows or layers of vitriol, ſtratifying them as before: then put the crucible again in the ſame place of the furnace: this repeat ſix times ſucceſſively, and you will have an excellent feretto; which beat to powder, and it will tinge glaſs of an extraordinary beautiful colour.

a white glaz'd pot, ſet it in the furnace to melt, and refine the matter; after which caſt it into water, and when dry'd, throw it again into the pot: when melted, obſerve whether the colour is to your liking: if ſo, let it ſtand for ſome time longer to refine. If you find the colour too faint, add more of the tinging powder.

A Black Enamel.

TAKE of the principal powder two pound, prepar'd zaffer one ounce, and prepared magneſia one ounce; pulverize and mix theſe, and proceed as directed in the preceeding colours. *Or,*

TAKE of the principal powder three pound, zaffer one ounce, crocus martis one ounce, feretto of *Spain* one ounce; pound and mix them, and proceed as directed before.

A Velvet black Enamel.

OF the principal powder two pound, red tarter two ounces, prepar'd magneſia one ounce, pulverize theſe and put them into a glaz'd pot, bigger than ordinary, becauſe the metal will riſe; for the reſt, proceed as directed before.

A purple Colour Enamel.

OF the principal powder two pound, prepar'd magneſia one ounce, indigo-blew half an ounce; proceed as above. *Or,*

PRINCIPAL powder three pounds, prepar'd magneſia one ounce and a half, of twice calcin'd ſcales of copper three ounces, ſtone-blew one ounce; pulverize, and proceed as directed.

A Violet Enamel.

OF the principal powder three pounds, prepar'd magneſia one ounce, thrice calcin'd copper ſcales 24 grains, terra verte one ounce; pulverize and mix theſe all together, and proceed as before directed.

A Yellow

A Yellow Enamel.

OF the principal powder three pound, tartar one ounce and a half, prepar'd magneſia 6 grains, yellow orpiment two ounces, arſenick one ounce; pulverize them, and proceed as before directed.

An excellent Red Enamel, of a very ſplendid Ruby Colour.

THIS enamel is of a ſurpriſing beauty, and its luſtre equals that of a red ruby. To prepare this, take equal quantities of magneſia of *Piedmont*, and ſaltpetre; let them reverberate and calcine in an earthen pot in a furnace for 24 hours; take it then off, and waſh it well in warm water, to ſeparate the ſaltpetre; dry it well, and the maſs will be of a red colour: to this add an equal quantity of ſal-armoniac; grind this on a marble with diſtill'd vinegar, as painters do their colours, dry it and pulverize it: then put it into a ſtrong matraſs, let it ſublimate for 12 hours; break off the neck of your matraſs, and mix all the volatile and fixed parts together, adding the ſame quantity of ſal-armoniac as there are flowers, and take care to weigh them before the compoſition; grind, pulverize and ſublimate as before, repeating this until your magneſia remain fuſible at the bottom of the matraſs: this preſerve to tinge your cryſtal with, and according to your liking, add either a greater or leſſer quantity of the magneſia or elſe of the cryſtal, till you have brought it to its degree of perfection.

A Roſe Colour Enamel.

TAKE five pound of ground cryſtal, melt it in a glaz'd pot, add at four different times two ounces and a half of thrice calcin'd copper; ſtir the metal every time, then pour into it crocus martis and magneſia prepared as directed; let it ſtand for ſix hours to cleanſe, and if the colour is too light, add a little more crocus martis, till it be of a fine roſe colour.

Obſerve that all the colours, which are not pure enamel, muſt be incorporated with the cryſtalline matter, to the end they may vitrify the better, which elſe they would not eaſi do. Moſt workmen make uſe of rocaille; but that does no anſwer the purpoſe ſo well as ground cryſtal.

A fine Purple.

TAKE half an ounce of fine gold; neal it, and beat into very thin plates; diſſolve this in four ounces o aqua fortis, regulated with ſal-armoniac, or old ſtron ſalt; put it into a glaſs cucurbit, which ſet on warm aſhes o ſand, to diſſolve; put to it a ſmall matter of ſaltpetre; whe all is diſſolved, drop two or three drops of oil of tarta into it, and ſtop the cucurbit cloſe, to prevent its boiling over then put in ſome more drops of oil, and repeat this till it ebul lates or boils no more. After this, put ſome lukewarm rai water to it, and let it ſtand for ſome time, and a powder wil ſettle at the bottom of the cucurbit; then pour off the wate leiſurely into an earthen or glazed receiver; put more freſh water to the ſediment, and repeat this till the water comes of clear, and free from the ſharpneſs of the aqua fortis. When the powder is ſettled, and all the water pour'd from it, then put it upon a piece of whited brown paper, to ſeparate it from the reſt of the water, and dry it on a warm tile, or in the ſun. To one part of this powder, add ſix parts of the principal powder; grind it with oil of ſpike, and it will make a good purple.

A good Red Enamel Colour.

TAKE clean *Hungarian* vitriol, put it into a copper cup, hold it over a fire, and ſtir it with a ſilver or copper wire, till it is reduc'd to a white powder; burn this upon a hot tile, on which let it cool of itſelf; then waſh it with rain-water, and when ſettled, pour off that, and put freſh water on, and thus repeat it ſeveral times.

But ſome artiſts, inſtead of waſhing this powder, boil it in fair water, and think this method better than that of waſhing. With this powder you tinge the principal matter to what height you would have your colour. *Or,* DISSOLVE vitriol in an earthen pan, and it will fix and ſhoot at the ſides thereof into cryſtals; which take and burn over a gentle fire between two crucibles well luted: when thus you have burnt it to a powder, take and boil it in clean water; and when done, dry it; of this take one part, of the principal powder three parts, and of tranſparent yellow one and ½ part. *Or,*

PUT vitriol into a crucible, pour a little aqua fortis upon it, and neal it gently; then put it in a clean earthen pipkin, pour clean water upon it, and boil it one hour; then pour off that, and put freſh water upon it; waſh it, and when ſettled dry it; neal it once more, and it is fit for uſe. Of this powder take two parts, and of the principal powder or flux, three parts.

A Flux for Red Enamel.

TAKE of red lead four ounces, white ſcouring ſand one ounce; melt it, and pour it into an iron mortar.

Some General Obſervations.

BEFORE we proceed to another ſubject, we will conclude this article with a few obſervations and general rules, for the more eaſy apprehending of what has been ſaid already.

You may obſerve, that gold is the moſt proper metal to enamel upon: that every colour, except a violet or purple, receives an additional beauty from it, to what it does from ſilver or copper: that it is propereſt to enrich gold with ſuch beautiful colours, ſince they raiſe an agreeable admiration in the beholder, when the ſkilful artiſt places them in due order.

The ancients only painted in black and white, with ſomething of a carnation or fleſh colour; in ſucceſs of time they indeed made ſome few improvements, but all their enamel colours were equally alike on gold, ſilver, or copper, every one tranſparent, and every colour wrought by itſelf. But ſince the modern artiſts have found out a way of enamelling with opaque colours, and of compounding them in ſuch a manner as to ſhade or heighten the painting therewith; in the ſame manner as is done in miniature, or oil painting, this art has gained the pre-eminence in ſmall portraitures; it having the advantage of a natural and laſting luſtre, which is never tarniſhed nor ſubject to decay.

The purple coloured enamel does beſt on ſilver, from which it receives an agreeable beauty; ſo does the egmarine, azure and green: all other colours, as well clear as opaque, do not ſuit therewith; copper ſuits with all thick enamels, but is unfit for that which is clear.

You muſt obſerve to make choice of good, hard, and laſting enamel; the ſoft is commonly full of lead, which is apt to change the colours, and make them look ſullied and foul; but if you follow our preſcriptions, you will meet with no ſuch inconveniencies.

Remember when you lay your white enamel on either gold, ſilver, or copper, to dilute it with water of quince-kernels, as has been directed; your clean enamel colours mix only with fair water; and the opaque, when mix'd with flux or the principal powder, dilute with oil of ſpike.

Be careful not to keep your work too long on the fire, but take it often out; to ſee when it has the proper glazing, and then it is finiſhed.

Before you uſe your enamels, give them a little preparation; the moſt approved by goldſmiths is, to take the enamel, and after you have ground it to a fine powder, pour on it a little aqua fortis, and afterwards purify and refine it in a ſmall glaſs cucurbit; then waſh it ſeveral times in fair water; dry it, and lay it up carefully to keep it from duſt: When you uſe it; grind as much as you have occaſion for, with fair water in an agat mortar; thus do with all your clear and tranſparent enamels, and by this means you will have all things in readineſs to proceed in your work with pleaſure.

All opaque colours that will ſtand the fire, are fit to be uſed in painting enamel; and the ingenious artiſt will not be at a great loſs, but in ſearching after them will meet with ſeveral colours not yet diſcovered; as it frequently happens to thoſe who try experiments, and are in purſuit of new diſcoveries, in this as in any other art.

Of Artificial PEARLS.

IT will not be improper to treat in this place on this ſubject, as it is a branch relating to jewellers.

The ancients, who wrote on the ſeveral ſorts of precious ſtones, ranged pearls among the jewels of the firſt claſs; they have at all times been in high eſteem, and have been eagerly ſought for, particularly for adorning the fair ſex.

The oriental pearls are the fineſt, on account of their largeneſs, colour, and beauty; being of a ſilver white; whereas the occidental or weſtern pearls ſeldom exceed the colour of milk. The beſt pearls are brought from the *Perſian* gulf, above the iſles of *Ormas* and *Baſſora*. They are found in *Europe* both in ſalt and freſh waters; *Scotland*, *Sileſia*, *Bohemia* and *Friſia*, produce very fine ones; tho' thoſe of the latter country are but very ſmall.

Art, which is always buſy to mimick nature, has not been idle to bring counterfeit pearls to the greateſt perfection; they are imitated ſo near, that the naked eye cannot diſtinguiſh them from the pearls of the firſt claſs, or the real ones, and by this means the wearing of pearls is become univerſal.

We ſhall here preſent the curious with ſeveral receipts how to counterfeit pearls in the beſt manner, and after a method both eaſy and ſatisfactory, ſo as to render his labour pleaſant and delightful, and to anſwer his expectation.

To imitate fine ORIENTAL PEARLS.

TAKE of thrice diſtill'd vinegar two pound, *Venice* turpentine one pound; mix them together into a maſs and put them into a cucurbit, fit a head and receiver to it, and after you have luted the joints, ſet it, when dry, on a ſand furnace, to diſtil the vinegar from it; don't give it too much heat, leaſt the ſtuff ſhould ſwell up.

After this put the vinegar into another glaſs cucurbit, in which there is a quantity of ſeed pearl, wrapt in a piece of thin ſilk, but ſo as not to touch the vinegar; put a cover or head upon the cucurbit; lute it well, and put it in *Bal. Mariæ*, where you may let it remain a fortnight. The heat of the *Balneum* will raiſe the fumes of the vinegar, and they will ſoften the pearls in the ſilk, and bring them to the conſiſtence of a paſte; which being done, take them out, and mould them to what bigneſs, ſhape and form you pleaſe. Your mould muſt be of fine ſilver, the inſide gilded; you muſt alſo refrain from touching the paſte with your fingers, but uſe ſilver gilded utenſils, with which fill your moulds: When you have moulded them, bore them through with a hog's briſtle, or gold wire, and let them dry a little; then thread them again on a gold wire, and put them in a glaſs; cloſe it up, and ſet them in the ſun to dry; after they are thorough dry put them in a glaſs matraſs into a ſtream of running water, and leave them there 20 days; by that time they will contract the natural hardneſs and ſolidity of pearls. Then take them out of the matraſs, and hang them in mercury water*, where they will moiſten, ſwell, and aſſume their oriental beauty; after which ſhift them into a matraſs, hermetically cloſed up, to prevent any water coming to them, and let it down into a well, to continue there about eight days; then draw the matraſs up, and in opening it, you will find pearls exactly reſembling oriental ones. This method is very excellent, and well worth the trouble, ſince by experimenting ſo fine a ſecret one will have the ſatisfaction of ſeeing the performance anſwer the direction above expectation.

Another Way to make artificial Pearls.

TAKE oriental ſeed pearls, reduce them into a fine powder on a marble, then diſſolve them in mercury-water, or clarified juice of lemons. To make more diſpatch, ſet them in a cucurbit on warm aſhes, and you will ſee preſently a cream ariſe at the top, which take off immediately: Take the diſſolution off the fire, and when ſettled, pour off the liquid into another glaſs, and ſave it. You will have the pearl-paſte at the bottom, with which fill your ſilver gilded moulds, and ſo put them by for 24 hours: Then bore them through with a briſtle; cloſe up the moulds in barley dough, and put it in an oven to bake, and when about half baked, draw it out, take out your pearls, and ſteep them in the liquor you ſaved before, putting them in and taking them out ſeveral times; then cloſe them up in their moulds, and bake them again with the like dough; but let it remain in the oven till it is almoſt burnt, before you draw it out: After you have taken your pearls out of their moulds, ſtring them on one or more gold or ſilver threads, and ſteep them in mercury-water for about a fortnight; after which time take and dry them by the ſun, in a well cloſed glaſs, and you will have very fine and bright pearls.

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* Mercury-water is thus prepared. Take plate tin of *Cornwall*, calcine it, and let the calx be pure and fine; then with one ounce of the calx, and two ounces of prepared mercury, make an amalgama; waſh it with fair water, till the water remains inſipid and

Another Way.

DIſſolve very fine pulverized oriential pearls in alom-water; when the diſſolution is ſettled, pour off the water, and waſh the paſte that's ſettled, firſt in diſtilled waters, then in bean water, and afterwards ſet it in *Bal. Mariæ*, or horſe-dung, to digeſt for a fortnight; this done take out your glaſs, and the matter being come to the conſiſtence of a paſte, mould it as you have been directed before; bore and ſtring the pearls on a ſilver thread, and hang them in a well cloſed up glaſs limbeck,

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and clear; then dry the amalgama thoroughly, put it into a matraſs over a furnace, giving in ſuch a heat as is requiſite for ſublimation. When the matter is well ſublimated, take off the matraſs, and let it cool. Take out that ſublimate, add one ounce of *Venice* ſublimate to it, and grind it together on a marble; put this into another matraſs, cloſe it well, and ſet it upſide down in a pail of water: and the whole maſs will diſſolve itſelf in a little time into mercury-water; This done, filtre it into a glaſs receiver, ſet it on a gentle aſh fire to coagulate, and it will turn into a cryſtalline ſubſtance: This beat in a glaſs mortar with a glaſs peſtle to a fine powder, ſearce it through a fine ſieve, and put it into a matraſs, ſtop it cloſe up, and place it in *Baln. Mariæ*; there let it remain, till it reſolves again into water; which is the mercury-water, fit for the abovementioned uſe.

limbeck, to prevent the air coming to them: Thus dried, wrap every one up in leaves of ſilver, then ſplit a barbel, and cloſe them up in the belly thereof; make a dough of barley meal, and bake the fiſh, as you do bread; then draw him, take out your pearls, and dry them in a cloſed glaſs in the ſun.

To give them a tranſparency and ſplendour, dip them in mercury water, or inſtead thereof, take the herb *Gratuli,* ſqueez'd in water, put therein ſix ounces of ſeed pearl, one ounce of ſaltpetre, one ounce of roach alom, one ounce of litharge of ſilver; the whole being diſſolved, heat firſt the pearls, and then dip them in this diſſolution to cool; repeat this about ſix times running.

If your pearls ſhould not have their natural hardneſs, then take two ounces of calamy, or *Lapis calaminaris* in impalpable powder; add to this two ounces of oil of vitriol, and two ounces of the water of the whites of eggs; put them together into a retort, lute a receiver to it, and you will diſtil a fair water, with which, and ſome fine barley flower, make a paſte, in which coffin your pearls, and bake them as before; thus they will become exceeding hard.

Another Method.

TAKE chalk well purified and cleanſed from all groſneſ and ſand; of this make a paſte, and form thereof pearls, in a mould for that purpoſe; pierce them through with briſtle, and let them dry in the ſun, or in an oven; the ſtring them on a ſilver thread, colour them lightly over wit *Armenian* bole, diluted in the white of eggs, and when dry drench them with a pencil and fair water; lay them ove with leaf ſilver, and put them under a glaſs in the ſun to dry when dry poliſh them with a dog's tooth.

To give them the true colour, make a glue of vellum ſhav ings thus: After you have waſhed them in warm water, bo them in fair water, in a new earthen pot or pipkin, to ſom thickneſs, and then ſtrain them through a cloth. When yo would uſe it, warm it firſt, and dip your ſtring of pearls int it, but let there be an interval between each pearl, ſo not to touch one another; this will give your pearls a natur luſtre.

To form large Pearls out of ſmall ones, as directed by Korndorffer.

TAKE of mercurial water 14 ounces; put two ounces of *Sulph. Solis* into a low matraſs, pour the mercurial water upon it, and let it diſſolve and extract: Then take of the whiteſt ſmall pearls 20 ounces, put them into a proper matraſs, and pour the ſaid water upon it. The pearls will by degrees diſſolve, and at laſt turn to a clear calx, much like diſſolved ſilver calx: Pour off the mercurial water; boil the calx well out, and dry it; then put it into a clean crucible by itſelf; and melt and caſt it into what form you pleaſe. When cold, poliſh it in the ſame manner as you do gems or cryſtals, and you will have your work of the conſiſtence and beauty of the fineſt and cleareſt oriential pearl.

To make of ſmall Pearls a fine Necklace of large ones.

TAKE ſmall oriential pearls, as many as you will, put them into mercurial water 15 days andnights together, and they will turn ſoft, like a paſte; then have a pearl mould, made of ſilver; into this convey the paſte by a ſilver ſpatel or ſuch like implement; but you muſt not touch the paſte with your fingers, and be very careful to have every thing nice and clean about this work: When it is in the mould, let it dry therein; bore a hole with a ſilver wire thro' it, and let it ſtick thereon till you have more, but take care they don't touch one another; then have a glaſs wherein you may fix, as upon a pair of ſtands, your wires with the pearls; put them well cloſed up in the ſun to harden, and when you find them hard enough, put them into a matraſs; lute the neck thereof very cloſe, and ſink it in a running ſpring of water for 20 days, in which time they contract their natural colour.

To clean Pearls, when of a foul Colour.

TAKE pigeons dung, moiſten it with alum-water, to the conſiſtence of a paſte; put this into a glaſs, big enough to hold four times the quantity; put into this your yellow-coloured or foul pearls, ſo that they may be covered all over, and ſet them in a warm place, or behind an oven; let them ſtand for a month; then take them out, fling them into freſh cold alum-water and dry them carefully, and your pearls will become fine and white: If you repeat the operation once or twice, they will be done to greater perfection.

To blanch and cleanſe Pearls.

FIRST ſoak and cleanſe them in bran water; then in milk-warm water, and laſt of all ſteep them in mercury-water; Then ſtring and hang them in a glaſs; cloſe it well, and ſet them in the ſun to dry.

The bran water is made thus; Boil two good handfuls of wheaten bran in a quart of water, till all the ſtrength of the bran is drawn out, which uſe thus: Take a new glazed earthen pan, in which put your pearls on a ſtring, and pour the third part of the bran water upon it; when they have ſoaked, and the water is juſt warm, rub your pearls gently with your hands, to clean them the better, and continue this till the water is cold; then throw off that, and pour on another third part of the bran water that is boiling; proceed with this as you did before, and when cold, throw it away, and pour on the remainder of the water, ſtill proceeding as before; after this heat fair water, and pour it on your pearls, to refreſh them, and to waſh away the remains of the bran, by ſhifting them, and pouring on freſh warm water: This do thrice, without handling your pearls; then lay them on a ſheet of clean white paper; and dry them in a ſhade; then dip them into mercury water, to bring them to perfection.

Other Methods uſed in blanching of Pearls.

POUND alabaſter to an impalpable powder, rub the pearls therewith very gently; this will not only cleanſe them, but if you let them remain in this powder 24 hours afterwards, they will ſtill be the better for it. White coral has the ſame effect, uſed in the like manner.

White tartar calcined and diveſted of all its moiſture, is very good for the ſame purpoſe.

Salt, diſſolved, filter'd, coagulated, well dried and ground, is as effectual as any of the former things, for cleanſing of pearl, by rubbing them therewith; and if afterwards you lay them up in ſome coarſe ground millet, it will contribute to their natural brightneſs.

Of DOUBLETS.

DOublets being much in vogue, and the lapidaries arrived to ſuch a perfection in the making of them, that they often deceive even tolerable judges: I ſhall, for the ſake of ſuch as are unacquainted with the ſecrets thereof, ſet down ſome inſtructions, how they are made; and alſo how they may be known and diſtinguiſhed from real gems.

TAKE two drams of clear maſtick; and of the fineſt cleareſt *Venetian* or *Cyprian* turpentine 16 drams; diſſolve this together in a ſilver or braſs ſpoon: If you find there is too much turpentine, then add a little more maſtick to it, to bring it to a right temper. Then take what colour you pleaſe, as *Florentine* lake, dragon's blood, diſtill'd verdegreaſe, or what colour elſe you deſign, for repreſenting a particular ſtone; grind each by itſelf, in the niceſt manner you poſſibly can, and mix each apart with the mixture of maſtick and turpentine, which you ought to have ready by you; and you will find the *Florentine* lake to imitate the colour of a ruby, the dragon's blood that of a hyacinth, and the verdegreaſe the colour of an emerald. But in caſe you would have your colours, as it were, diſtilled, then get a little box, made of lime-tree, in the ſhape of an egg or acorn, as repreſented in Plate II. Fig 2.

This box muſt be turned at the bottom as thin as poſſible, ſo that the light may be ſeen through it. Then make a quantity of any one of the abovefaid colours, mix'd with the mixture of maſtick and turpentine, and put it into that little box, hung over a gentle glowing coal fire, or in ſummer-time in the heat of the ſum, where the colour will diſtil through very fine: Scrape and put this into little boxes of ivory, to preſerve it from duſt, for your uſe, it is neceſſary to have to every different colour ſuch a different wooden box.

When the colours are ready, take your cryſtals (firſt ground exactly to fit upon one another) and make your colours and ſtone of an equal warmth; lay your colour with a fine hair pencil on the ſides of the cryſtals that are to be join'd together; then clap them againſt each other as nimbly as poſſible: preſs them with your fingers cloſe together; let them cool; and it is done.

How to know a Doublet from a natural Stone.

TAKE a ſtone, in caſe you are dubious about it, and look upon it edge-ways againſt the light, and if it is a doublet, you will preſently ſee the clear cryſtal, or the glaſs, and ſo find out the impoſture.

The Cryſtal Glue of Milan

IS nothing elſe but grains of maſtick, ſqueezed out by degrees over a charcoal fire, and like a clear turpentine. The pieces which are to be glued together, are firſt warm'd over a coal fire, then the maſtick is put on the point of a bodkin and warm'd; when both are of an equal warmth, wipe your cryſtal or ſtone over with it, clap them upon one another, and preſs them together; what comes out about the ſides, ſcrape off as ſoon as it is dry, with a knife. This withſtands as well cold as hot water, except a fierce fire.

Some Remarks on Doublets.

ALL falſified jewels are made, either of a ſaphir, or two cryſtals, by putting a foyle between them, and cementing them together, as has been mentioned before, with maſtick. Theſe mimick'd ſtones may eaſily be diſcern'd by taking one of them between the two nails of your thumbs, and holding them againſt the light, directing your eye towards the middle of the ſtone; if the two outer parts appear white, and the middle of a different colour, you may conclude the ſtone to be falſe, and made by art.

A Peremptory Inſtruction concerning the FOYLES or LEAVES which are laid under PRECIOUS STONES.

IT is cuſtomary to place thin leaves of metal under precious ſtones, in order to make them look tranſparent, and to give them an agreeable different colour, either deep or pale: Thus, if you want a ſtone to be of a pale colour, put a foyl of that colour under it; again, if you would have it deep, lay a dark one under it: Beſides, as the tranſparency of gems diſcovers the bottom of the ring they are ſet in, artificers have found our means to give the ſtone an additional beauty, which without theſe helps it would be depriv'd of.

Theſe foyles are made, either of copper, gold, or gold and ſilver together: We ſhall firſt mention thoſe made of copper only, and are generally know by the name of *Nurinberg* or *German* foyles.

Procure the thinneſt copper-plates you can, the thinner they are, the leſs trouble they will give you in reducing them to a finer ſubſtance: Beat theſe plates gently upon a well poliſh'd anvil, with a poliſh'd hammer, as thin as poſſible; But before you go about this work, take two iron plates, about ſix inches long, and as wide but no thicker than writing-paper; bend them ſo as to fit one on the other; between theſe neal the copper-per you deſign to hammer for the foyles, to prevent aſhes or other impurities getting to them; put your copper foyles between theſe bended irons, lay them in the fire, and let them neal; then, taking them out, ſhake the aſhes from them, and hammer them till cool. Then take your foyles to the anvil, and beat them till they become very thin, and whilſt you beat one number, put in another between the irons to neal; this you may repeat eight times, till they are as thin as the work requires. You muſt have a pipkin with water at hand, in which put tartar and ſalt, of each an equal quantity, this boil, put the foyles in, and ſtir them continually, till by boiling they become white; Then take them from the fire, waſh them in clean water, dry them with a clean fine rag, and give them another hammering on the anvil, till they are fit for your purpoſe.

N. B. Care muſt be taken in the management of this work, not to give the foyles too much heat, to prevent their melting; neither muſt they be too long boil'd, for fear of attracting too much ſalt.

How to poliſh and colour the Foyles.

TAKE a plate of the beſt copper, one foot long, and about five or ſix inches wide, poliſh'd to the greateſt perfection: bend this to a long convex; faſten it upon a half roll, and fix it to a bench or table; then take ſome chalk, waſh'd as clean as poſſible, and filter'd through a fine linnen cloth till you think it cannot be finer; and having laid ſome thereof on the roll, and wetted the copper all over, lay your foyles upon it, and with a poliſh-ſtone and the chalk, poliſh your foyles till they are as bright as a looking-glaſs; and when ſo, dry them between a fine rag, and lay them up, ſecure from duſt. I ſhall now ſhew how theſe foyles are colour'd, but firſt give a ſhort deſcription of the oven or furnace that's requiſite for that purpoſe.

The furnace muſt be but ſmall and round, about a foot high, and as wide; cover the ſame with a round plate, in which muſt be a round hole, about four inches wide; upon this furnace put another without a bottom, of the ſame dimenſion as the former, and let the crevices of the ſides round about

PLATE. II.

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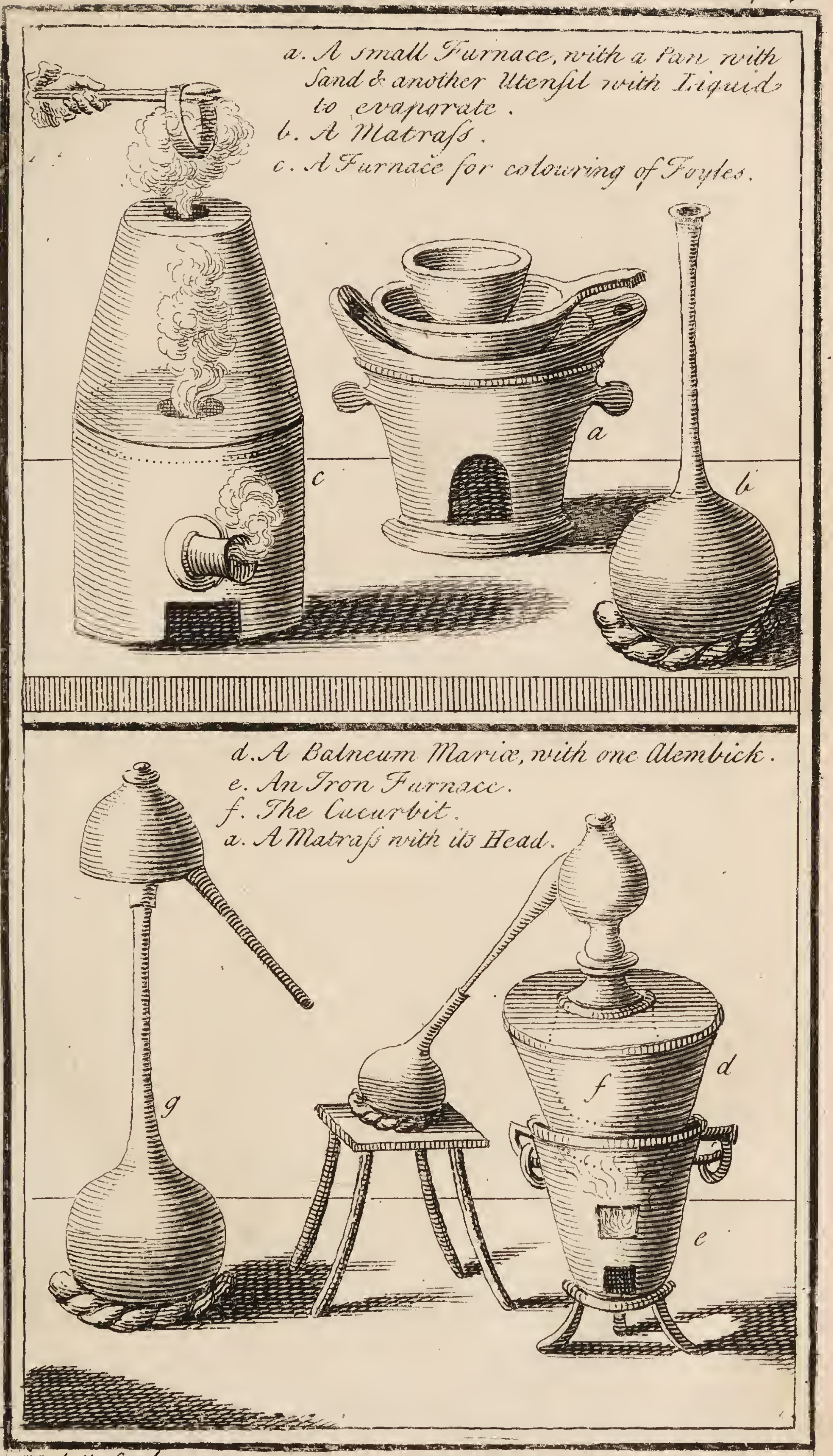

a. A small Furnace, with a Pan with Sand & another Utenſil with Liquid to evaporate.
b. A Matraſs.
c. A Furnace for colouring of Foyles.

d. A Balneum Mariæ, with one Alembick.
e. An Iron Furnace.
f. The Cucurbit.
a. A Matraſs with its Head.

Hulett Sculp

about be well cloſed and luted: this furnace muſt alſo have a hole at top. The lower furnace muſt have a little door at bottom, about five inches big. Before this fix a ſort of a funnel, like a ſmoak-funnel to an oven, and lute it cloſe to the furnace; then light ſome charcoal on your hearth, and when they burn clear, and free from ſmoak, convey them through the funnel into the furnace, till they come up ſo high as to fill half the funnel. When every thing is ready, and you have a clear fire, then begin to colour your foyles in the following manner.

Lay the foyles upon a pair of iron tongs, hold them over the hole that is at top of the furnace, ſo that the fumes of the coals may reverberate over them, and move them about till they are of a browniſh violet colour; and this is done without any other vapour or ſmoke. When you have done with this colour, put it by; and if you would colour others, of a ſaphir or sky blue, then put the foyles upon the tongs as before; and whilſt you with one hand are holding the foyles over the holes, fling with the other ſome down feathers of a gooſe, upon the live coals in the funnel, and with a red hot poker preſs them down, to drive the ſmoke of the feathers up through the holes of the oven, which by ſettling upon the foyles, gives them a fine sky colour: But you muſt have your eyes very quick upon them, and as ſoon as you ſee that they have attracted the colour you deſign, take them away from the oven, to prevent their changing into ſome other colour: But if you would have your foyles of a ſaphir blew, then firſt ſilver them over, which is done in this manner.

Take a little ſilver, and diſſolve it in aqua fortis; when diſſolv'd, put ſpring-water to it, fling thin bits of copper into it, and the water would look troubled, and the ſilver precipitate and hang to the copper; pour off that, ſweeten the ſilver with fair water, and let it dry in the ſun; when dry grind it on a porphyr-ſtone: Then take one ounce of tartar, and as much of common ſalt, mix and grind them all together, till they are well mixed; fling this powder upon the thin foyles, and rub them with your finger backwards and forwards, and it will ſilver them; then lay them upon the poliſher, pour water over them, and ſome of the powder, rub it with your thumb; till they are as white as you would have them: Poliſh them with a poliſher of blood-ſtone, and holding them over the gooſe feather ſmoak, they will take a fine dark blue.

To colour Foyles of a green Colour for an Emerald.

YOU muſt firſt colour your foyles of a sky blue, as directed before; then hold them over the ſmoak-hole, and below in the funnel lay upon the red hot iron plate, leaves of box, from which aſcends a ſmoak that gives the foyles a green colour; but before they attract that colour, they undergo ſeveral changes, as blue, then red, and again yellow, wherefore you muſt hold them ſo long, till you have the green colour to your mind.

To colour the Foyles of a Ruby *Colour.*

PUT the ſhearings of ſcarlet cloath upon the coals, and holding the foyles over the ſmoak-hole, they will attract a fine red colour.

The Colour of an Amethiſt.

MAY be had in proceeding with your foyles, as for the blue or ſaphir colour for before that blue colour comes, it firſt changes to an amethiſt; as ſoon as you perceive this, take them off, and poliſh them.

How the Foyles are mix'd with Copper and other Metals.

THESE are more difficult to make, but more laſting in their colour. Take one pound and a half of copper, and melt it in a crucible; fling into this two ounces and 11 pennyweight of gold; when in fuſion, poor it into a flat ingot, and let it cool: This beat and work, as has been taught, into thin foyles; then boil them in tartar and ſalt. Theſe ſort of foyles will take a fine ruby colour; nor can that colour be well done without this mixture.

Another Way.

TAKE ſmall-coal duſt, put it into a little iron oven, and in the midſt thereof a live charcoal; blow it till all the ſmall-coal duſt is lighted, and let this glow for two hours: When it is moſt all glown out, add ſuch another quantity to it, and let it glow for an hour. At the top of your oven muſt be a round or ſquare hole, with a cloſe cover to it, in which hang the foyles to ſome copper or iron wire: When your ſmall-coal has glow'd for about an hour, take a little iron bowl, and warm it well; put in it a little quantity of fox hair, and then ſet it upon the ſmall-coal duſt; ſhut the oven door, and open the top: This will draw the ſmoak through, and give the foyles firſt the colour of a ruby, then of an amethiſt, and at laſt of a ſaphir. You may take out ſuch colours as will ſerve your purpoſe; and if you want a green, let thoſe foyles hang, and burn ſage leaves till the foyles turn to a green colour. Take care to put but a few ſage leaves in at a time.

To the ruby and hyacinth colours uſe pure copper, but for an emerald and ſaphir you muſt take one part of gold and two parts of ſilver, and eight parts of copper; melted and work'd together.

Choice Secrets imitating PRECIOUS STONES, or for making ARTIFICIAL GEMS.

THIS curious art is arrived to that perfection that it is capable of imitating precious ſtones in their luſtre, colour, and beauty, even to ſurpaſs the natural ones except in hardneſs, which to obtain, has been, and no doubt ſtill are, the endeavours of ſeveral ingenious men.

The art of making artificial gems, conſiſts chiefly in rightly imitating the tints of thoſe that are real: Theſe muſt be extracted from ſuch things as reſiſt the fire, and do not change their colour, though of a volatile nature: Thus verdegreaſe being put into the fire, is changed to another colour, but when put in fuſion with cryſtal, it retains its natural colour.

You

You muſt therefore take ſuch colours as change not, when mixt together: Therefore ſince blue and yellow make a green, you muſt take ſuch blue as ſhall not hurt the yellow when you mix them; and alſo ſuch a yellow as ſhall not be detrimental to the blue, and ſo of the other colours. We ſhall give very plain and certain inſtruction, to carry the ingenious artiſt with eaſe and pleaſure through this labour, and firſt ſhew him

The Way of prepariug Natural Cryſtal.

TAKE natural cryſtal the cleareſt you can get, no matter how big the pieces are, fill a large crucible with them, and cover it with a lid broader than the mouth of the crucible, to prevent the falling of aſhes or coals into it: Then put it into a ſmall furnace, on burning coals; and when the cryſtal is thorough hot, caſt it into a pretty large veſſel of cold water. Then take it out of the water, dry it on an earthen plate, and put it into the ſame crucible again: Cover it, and proceed as before, repeating it 12 times running, and changing each time the water: When the cryſtal eaſily breaks and crumbles, and is thoroughly white, it is a ſign that it is calcin'd enough: If there appear any black parts in the veins, break off the white, and put theſe again into the furnace, and proceed therewith as before, till only the white remain behind.

After you have dried this calcined cryſtal thoroughly, grind it to an impalpable powder, on a marble or porphir ſtone, and ſearce it through a ſilken ſieve. Of this powder of cryſtal, as it is uſed for all artificial gems, of which we ſhall treat, it will be proper to have a ſufficient quantity by you, to have recourſe to, when at work; and if you would ſucceed in this art, you muſt not uſe ordinary frit of cryſtal, be it ever ſo good; for that will not anſwer, or come up to the luſtre or beauty of natural cryſtal.

To Counterfit an Ophal.

AT *Harlem* they make counterfeit opal glaſs, which is very lively, and whoſe ſeveral colours are ſuppoſed to be produced by different degrees of heat, when the compoſition is thoroughly melted, ſome of it taken out on the point of an iron rod, which being cooled either in the air or water, is colourleſs and pellucid, but being put again into the mouth of the furnace upon the ſame rod, and turned round for a little time, its particles acquire ſuch various poſitions, as that the light falling on them being variouſly modified, repreſents the ſeveral colours obſervable in the true opal. And it is remarkable that theſe colours may be deſtroy'd, and reſtor'd again by different degrees of heat.

To make a fair Emeral.

TAKE of natural cryſtal four ounces, of red lead four ounces, verdegreaſe 48 grains, crocus martis prepared with vinegar eight grains; let the whole be finely pulverized and ſifted. Put this together in a crucible, leaving one inch empty; lute it well, and put it into a potter's furnace, where they make their earthen ware, and let it ſtand there as long as they do their pots. When cold, break the crucible, and you will find a matter of a fine emerald colour, which, after it is cut and ſet in gold, will ſurpaſs in beauty an oriental emerald. If you find that your matter is not refin'd or purified enough, put it again the ſecond time in the ſame furnace, and in lifting off the cover you will ſee the matter ſhining; you may then break the crucible, but not before; for if you ſhould put the matter into another crucible, the paſte would be cloudy, and full of bliſters. If you cannot come to a potter's furnace, you may build one yourſelf with a ſmall expence, in which you may put 20 crucibles at once, each with a different colour, and one baking will produce a great variety of artificial gems. Heat your furnace with hard and dry wood, and keep your matter in fuſion 24 hours, which time it will require to be thoroughly purified; and if you let it ſtand four or ſix hours longer, it will not be the worſe for it.

A deeper Emerald.

TAKE one ounce of natural cryſtal, ſix ounces and a half of red lead, 75 grains of verdegreaſe, 10 grains of crocus martis, made with vinegar; proceed as directed before. *Or.*

TAKE prepar'd cryſtal two ounces, red lead ſeven ounces, verdegreaſe 18 grains, crocus martis 10 grains, and proceed as before directed.

To make a Paſte for imitating an Oriental Topaz

THE colour of this ſtone is like water tinged with ſaffron or rhubarb: To imitate it, take of prepared natural cryſtal one ounce, of red lead ſeven ounces, finely pounded and ſearced; mix the whole well together, and put it into a crucible, not quite full by an inch, leaſt the matter ſhould run over, or ſtick to the cover of the crucible in riſing; then proceed as directed above. *Or*,

TAKE prepar'd cryſtal two ounces, native cinnaber two ounces, *Æs uſtum* two ounces, all finely pulveriz'd and ſearced; four times as much calcined tin; put it all together into a crucible well covered, and proceed as before.

To make an Artificial Chryſolite.

THIS ſtone is of a green colour, and ſome have the caſt of gold; to imitate it, take natural cryſtal prepar'd two ounces: red lead eight ounces, crocus martis 12 grains; mix the whole finely together, and proceed as before, only leaving it a little longer than ordinary in the furnace.

To Counterfeit a Beryl.

THIS ſtone is of a blueiſh ſea-green: To imitate it, take two ounces of natural cryſtal prepared, five ounces of red lead, 21 grains of * zaffer prepared, the whole finely pulverized; put it in a crucible, and cover and lute it; then proceed as directed above, and you will have a beautiful colour.

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* Preparing of zaffer may be done, by puttingſome pieces into an iron ladle, heating it red hot, and then ſprinkling it with ſtrong vinegar, when cold grind it on a ſtone; then waſh it in clear water.

A Saphir Colour.

A Saphir is generally of a very clear ſky colour, and is highly eſteemed for its beauty. There are ſome of a whitiſh colour, like diamonds, others a full blue, and ſome are of a violet.

To make this paſte, take of prepar'd rock cryſtal two ounces, red lead four ounces and a half, ſmalt 26 grains; pulverize and proceed as directed. This colour will come near to a violet.

Another more beautiful, and nearer the Oriental.

TAKE two ounces of natural cryſtal prepared, ſix ounces of red lead, two ſcruples of prepared zaffer, and ſix grains of prepared manganeſe; all reduced to a fine powder, mix and proceed as before.

Another deeper coloured Saphir.

OF prepared natural cryſtal take two ounces, red lead five ounces, prepared zaffer 42 grains, prepared manganeſe eight grains; the whole reduced to an impalpable powder, and mixed together; proceed as you have been directed, and you will have a colour deeper that the former, tending to a violet.

To make a Paſte for an Oriental Granat.

A Granat is much like a carbuncle; both, if expoſed to the ſun, exhibit a colour like burning coals, between red and yellow; and this is the true colour of fire. To imitate this ſtone, take two ounces of natural cryſtal prepared, and ſix ounces of red lead, alſo 16 grains of prepared manganeſe, and two grains of prepared zaffer; pulverize and mix the whole; put it together into a crucible, and proceed as directed.

Another deeper Granat.

OF natural cryſtal prepared take two ounces, red lead five ounces and a half, prepared manganeſe 15 grains; pulverize all, and proceed as before directed.

Another Proceſs for counterfeiting of PRECIOUS STONES.

TAKE of black flint-ſtones what quantity you pleaſe, and put them into a pail of hot water ; and being wet, put them into a hot furnace, this will prevent their flying into ſmall pieces ; or elſe warm them thoroughly by degrees, before you put them into the furnace. When you ſee that they are thorough red hot, then quench them in fair water, and they will look of a fine white colour ; dry and pulverize them very fine : This you may do in an iron mortar ; but as it may contract ſome of the iron, it will be proper after you have taken it out, to pour on it ſome aqua fortis, which will clear it of the iron, and ſo diſengage it from all filth and impurities ; waſh it in ſeveral clean hot waters.

This powder thus prepared is fit to be uſed for making the fineſt glaſs, and for imitating the cleareſt and moſt tranſparent gems, eſpecially thoſe that require the luſtre of a diamond or ruby ; as for a ſaphir, emerald, topaz, chryſolite, ſpirel, amethiſt, &c. your labour with aqua fortis may be ſaved, if your mortar is bright and free from ruſt. Such as have a mortar of porphir, or ſuch like ſtone, have no occaſion to uſe an iron one, but will ſave themſelves a good deal of trouble.

In caſe you cannot have black flint-ſtones you may content yourſelf with pebble ; but flint is far preferable, and makes the glaſs of a harder ſubſtance than that made of pebble.

An approved Compoſition.

OF the above powder take three parts, refined ſaltpetre two, borax and arſenick one part. *Or,*

OF the flint powder three parts, ſaltpetre two, and borax four parts. *Or,* OF the aforeſaid powder two parts, of refined cryſtalline pot-aſhes, or ſalt of tartar and borax, of each one part. *Or*,

TAKE of the above powder ſeven parts and a half; purified pot-aſhes five parts. *Or*,

POwder ſix parts and a half; ſaltpetre two and a half; borax one half; arſenic one half; and tartar one part.

How to melt theſe Compoſitions, and how to tinge and finiſh your Work.

TAKE any one of the above ſpecified compoſitions, and weigh what quantity you pleaſe, one or two ounces; then mix it with ſuch a colour as you deſign to have it of, as for inſtance,

To make a Saphir.

TAKE to one ounce of the compoſition four grains of zaffer, mix it well together, and melt it in a crucible; if you ſee the colour to your liking, proceed to finiſh it: You may make a ſaphir either deeper or paler, according to what quantity you take of each ingredient; and 'tis the ſame with reſpect to other colours. A new practitioner in this art may make experiments in ſmall crucibles, in order to acquaint himſelf with the nature thereof.

I have already given receipts of moſt colours for imitating of precious ſtones, but nevertheleſs I ſhall here lay down ſome experimental rules, neceſſary to be obſerved.

You muſt know, that the crocus martis may be prepared different ways, and each will have a particular effect in colouring of cryſtals; one is prepared with vinegar, another with ſulphur, a third with aqua fortis, and a fourth by only a reverberatory fire.

To prepare Crocus Martis with Vinegar.

TAKE iron; or, which is better, ſteel filings, moiſten and mix them up with good ſtrong vinegar in an earthen diſh or pan; after which ſpread them and let them dry in the ſun; when dry, beat them fine in a mortar: Moiſten this powder again with freſh vinegar, and dry and beat it again as before; repeat this eight times running, afterwards dry and ſift it through a fine hair ſieve, and it will be of the colour of brick-duſt; but when mixt with glaſs, of a fine crimſon colour. Put this powder up carefully to preſerve it from duſt.

To prepare Crocus Martis with Sulphur, or Brimſtone.

TAKE iron or ſteel filings one part; ſulphur three parts; mix them together, and put them into a crucible; cover and lute it well; then ſet it into a wind-furnace, and give it a ſtrong fire with charcoal for four hours together, then ſhake it out, and when cold, pulverize and ſift it through a fine ſieve. This powder put into a crucible, lute it, and place the ſame in the eye or hole of the glaſs furnace; let it ſtand there for 14 days or more, and it will turn to a red powder inclining to purple; this is a very uſeful ingredient for tinging of glaſs.

To prepare Crocus Martis with Aqua Fortis.

MOiſten ſome iron or ſteel filings in a glazed earthen plate or diſh with aqua fortis, ſet it to dry in the ſun or air; when dry grind it to a fine powder: Moiſten it again with freſh aqua fortis, dry it and proceed as before, repeating it ſeveral times, till you ſee it of a high red colour; then grind and ſift it thro' a fine hair ſieve, and lay it up ſafe from duſt for uſe.

To prepare Crocus Martis by a reverberatory Fire.

TAKE clean iron or ſteel file-duſt, put thereof into a large pot or pan about the quantity of an inch high, cover it well, and put it into a reverberatory furnace, or any other place where it may be ſurrounded with a ſtrong heat and flame. The iron will ſwell and riſe in a fine red powder, ſo as to fill the pot, and will ever force up the lid; take of this powder, and you will find a good quantity of iron caked together at the bottom, which put again into the furnace, where it will ſwell, and riſe into a powder, as before; this continue till you have a ſufficient quantity. This is the moſt valuable crocus, and of great uſe in the art of colouring or tinging of glaſs for counterfeiting of precious ſtones.

To make a fine Hyacinth.

TAKE of crocus martis, or of that iron powder prepared by reverberation, 8 or 10 grains to one ounce of the compoſition.

The Opal

IS made of ſilver diſſolved in aqua fortis, precipitated with ſalt; add to it ſome load-ſtone, and mix it up with the above compoſition, it gives divers colours, ſo as to repreſent a natural opal.

A reddiſh Stone

MAY be made of the fragments or waſte of calcedon, mixed with borax and melted; with which you may make as many changes as you pleaſe.

Such as will ſave themſelves the trouble of preparing the compoſition for counterfeiting precious ſtones, may uſe fine cryſtal or *Venice* glaſs, beat in a clean mortar to a fine powder; of this take eight ounces, borax two ounces, refined ſaltpetre one ounce. From this mixture you may melt and colour all manner of ſtones, with little trouble.

Bartholomew Korndorffer's *Secret, to make a Diamond of natural Cryſtal.*

TAKE the beſt poliſhed cryſtal, no matter whether large or ſmall, ſo it is but clear and tranſparent; put it in a crucible, with three times as much of my fixed ſulphur of gold, ſo that the cryſtal may be covered all over with it. Then after you have put a lid over it and luted the crucible well, let it for three days and nights neal in a ſtrong fire; then take it out and quench it in ſpring water, in which red hot ſteel has been quenched 46 times running, and you will have a diamond which reſembles a natural one in every reſpect, and is right and good.

Thus far *Korndorffer*, but as to his ſulphur he has left us in the dark.

How to make a Diamond out of a Saphir, according to Porta's *Deſcription.*

WE uſe to make it (the diamond) the ſureſt way in this manner: We filled an earthen pipkin or crucible, with quick-lime, and laid the ſaphir in the midſt thereof, covering it firſt with a tile, and then with coals all over, blowing them gently till we had a clear fire; for if it is blown too much, it may occaſion the breaking of the ſtone.

When we thought that the ſaphir had changed its colour, we let the fire go out of itſelf; and took it out to ſee whether it was turnep white; if ſo, then we laid it again in the crucible, in order to let cool with the fire; but if it had not the right colour, then we augmented the heat again as before, and looked often to ſee, whether the force of the fire had taken away all the colour, which was done in about five or ſix hours; if then the blue colour was not quite gone, we began our operation afreſh, till it was white and clear. It is to be obſerved that the heat of the fire in the beginning of your operation muſt increaſe by ſlow degrees, and alſo in the ſame manner decreaſe; for if the ſtone comes either too ſuddenly into the heat, or from the heat into the cold, it is apt to turn dark, or fly to pieces.

In like manner all other precious ſtones loſe their colour, ſome ſooner than others, according as they are either harder or ſofter. The amethiſt is very light, and requires but a ſlow fire, for if it has too much heat, it becomes dark, or turns in chalk.

This is the art whereby inferior precious ſtones are changed into diamonds; they are afterwards cut in the middle, and a colour given them; and from hence comes the ſecond ſort of falſe diamonds, or doublets.

To make a fine Amethiſt.

TAKE calcined flint-ſtone, and ſift it thro' a cambrick, whereof take $\frac{3}{4}$ of an ounce, of fixed ſaltpetre $\frac{1}{4}$ of an ounce; of borax $\frac{3}{4}$ of an ounce; of *Tinct. Ven.* and *Mart.* $\frac{1}{4}$ of an ounce; manganeſe $\frac{1}{4}$ of an ounce; put both theſe tinctures together, and then mix them with the ingredients. Then add fix'd nitre * and borax well mixed to it; put it in a crucible into a wind furnace; give it at firſt a gentle heat, till it is red hot, and thus keep it for a quarter of an hour; then give it a ſtrong fire for two or three hours, at laſt pour it into a mould, and let it cool by degrees, to prevent its flying aſunder.

To make a Ruby, or a fine Hyacinth.

TAKE vitriol one ounce, and the ſame weight of water, mix it well together; in this diſſolve filings, or very thin beaten ſteel; ſet the glaſs on warm ſand, filtrate the ſolution before it is cold; then ſet it in a cellar, and it will ſhoot into cryſtals, which pulverize; put it under a muffel, and ſtir it till you ſee it of a crimſon colour; Then take it off the fire, put it in a vial, pour on it good diſtilled vinegar, and after it has ſtood four days in a gentle warmth, pour off that vinegar, and pour freſh to it, and let it ſtand four days more; this repeat till the vinegar is obſerved to make no extraction; then pour off the vinegar, and there will remain at the bottom of your vial a crimſon coloured powder; ſweeten this well with warm water. This is the tincture for the ruby or hyacinth.

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* The fixe dnitre is thus made; Take a piece of green oak, about two fingers thick, lay it upon an iron plate, into the middle of the top of the wood put a little heap of ſaltpetre; light it; and repeat it ſo often till it burns through the wood, and the ſaltpetre runs upon the iron; it turns at firſt blue, but afterwards greeniſh; you muſt keep it warm and dry; to prevent it from melting; in this manner one may make as much as one pleaſes.

Then take black flints, calcine them well, as has been already directed, in order to bring them to a good white powder, and ſift this thro' a cambrick; take thereof, and of *Venice* borax, of each ½ an ounce; of the aforeſaid tincture powder eight or nine grains, mix it well together in a crucible, and give it for half an hour a gentle fire; then augment it by degrees, till you ſee your mixture in the crucible as clear as cryſtal, and of a crimſon colour; then pour it into a mould of what ſhape you would have it.

To make a Ruby Palais

TAKE prepared powder'd flint three ounces, fix'd ſaltpetre one quarter of an ounce; borax three grains; ſome of the abovementioned tincture powder; of copper and iron 54 grains; of prepared mangameſe five grains; mix all together and put it into a new crucible; give it at firſt a gentle fire till it begins to melt, then give it a ſtrong fire for two hours and let it cool of itſelf.

To harden Bohemian *Diamons.*

TAKE black lead two ounces, gold talc two ounces, powder it fine, and mix it well together; then take of this mixture, put it into a new crucible, about half full, and place the ſaid diamonds upon that powder; ſo as not to touch one another; then put of the powder as much upon them as will fill the crucible; cover and lute it, and ſet it in a coppel with aſhes, ſo as to have the aſhes a hand's breadth about the crucible; then give it a ſlow fire, and augment the heat by degrees, in order to preſerve the ſtones from breaking, till the pan or coppel, which holds your crucible, begins to be red hot; continue it thus for 48 hours, then let it cool, and take the ſtones out of the crucible, and you will find them look black; poliſh them with aſhes of tin, they will not only have contracted a tolerable hardneſs, but have alſo a fine luſtre, much reſembling natural diamonds.

A plain Direction concerning the Poliſhing of theſe Counterfeits, and alſo of natural Gems.

IT is to be obſerved, that all glaſs or artificial ſtones may be cut and poliſhed after one method, namely, by ſtrewing fine powdered emery upon a leaden plate, with water, and holding the ſtone firm; grinding it in what form or ſhape one pleaſes.

If you fling ground tripoli, mixed with water, upon a pewter plate, and add a little copper-aſhes amongſt it, it will have the ſame effect.

Pulverized antimony ſtrewed upon a ſmooth plate of lead, with tripoli and vinegar, poliſhes not only glaſs, cryſtal, granets, calcedons, agats and amethiſts, but all other natural ſtones, except the diamond. The diamond is only cut with the diamond powder itſelf. Any ſuch diamonds, which can be touched by emery, lead, copper or other metals, or be cut therewith, are falſe; and this is a good teſt for knowing a real diamond.

All other precious and hard ſtones may be ground or cut with metal and emery, but the poliſhing is different.

The ſaphir is next to the diamond the hardeſt; it may be poliſhed beſt with antimony and vinegar, or lead, or with calcined flint-ſtone and water, upon copper.

The ruby is poliſhed like the ſaphir.

The emerald and turquoiſe is poliſhed with potter's clay and water, on pear-tree wood, or with tripoli upon wood, or with emery upon pewter.

The beryl is poliſhed with calcined mother of pearl, or muſcles, upon a board covered with white leather.

A pallas is poliſhed with antimony, upon copper.

The cornelian, onyx, agate, calcedon and jaſpis, upon tin; with tripoli or calcined flint upon pear-tree wood; or with antimony upon lead.

The amethiſt, topaz, turqoiſe and other ſoft ſtones, are poliſhed upon a board of lime-tree wood, upon a plate of tin, and upon a board with leather. Firſt poliſh it top and bottom, upon the wood; the ſmall diamond cuts are done upon the plate of tin, and receive the laſt poliſhing upon the board that's covered with leather, with the following powder.

A

A Powder for poliſhing ſoft Stones.

TAKE iron ſcales, mix them with vinegar and ſalt, and let them ſtand thus infuſed for three or four days, the longer the better; then grind the mixture very fine; dry it, and put it in an earthen pot well luted; give it a good fire, and it will be fit for uſe.

PART III.

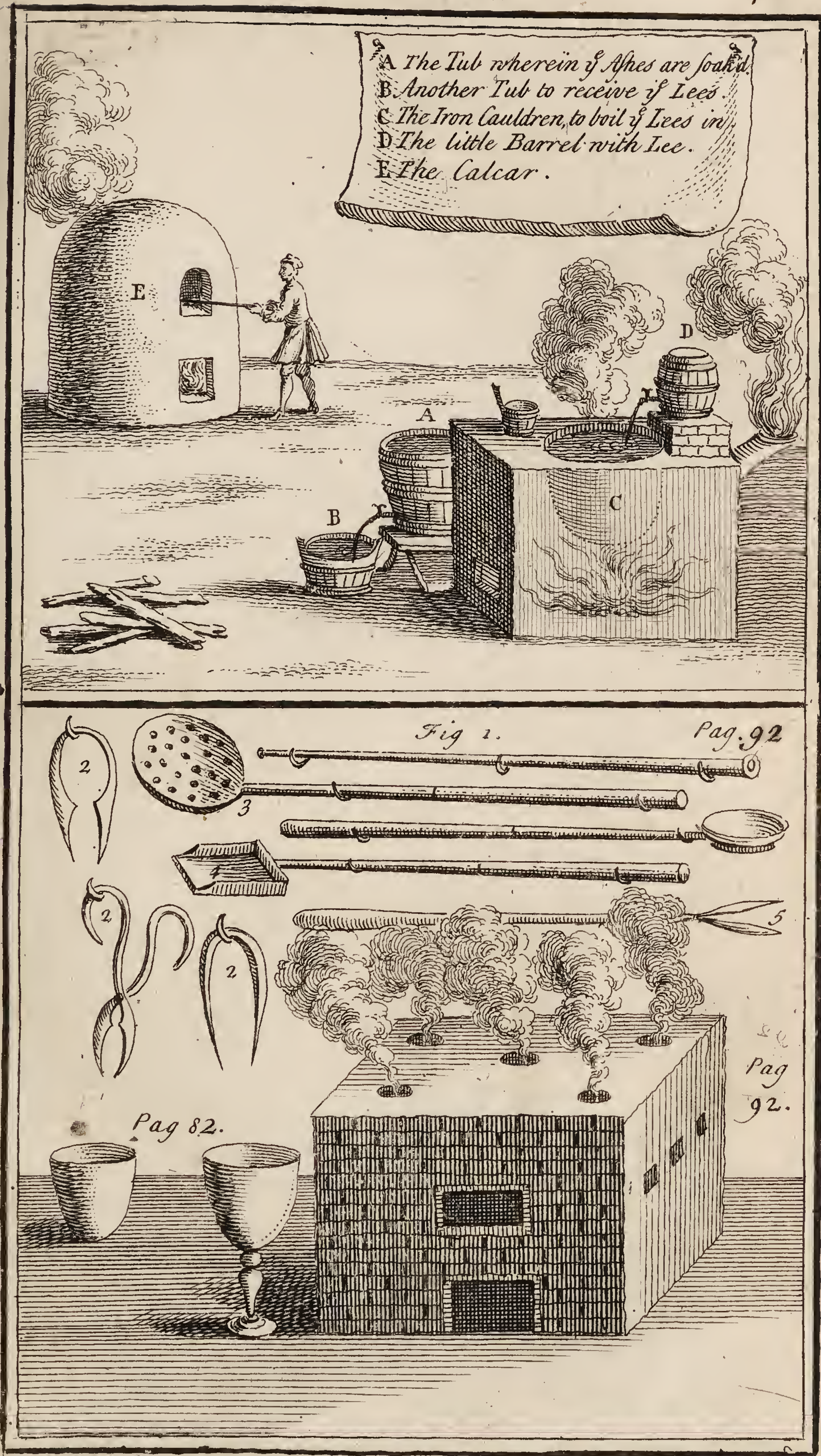
The Art of making GLASS: Exhibiting withal the Arr of Painting, and making Impreſſions upon GLASS, and of Laying thereon *Gold* or *Silver*; together with the Method of Preparing the Colours for POTTERS-WORK or DELFT WARE.

To prepare Aſhes for making GLASS.

TAKE what quantity, and what ſort of wood-aſhes you will, except thoſe of oak; have a tub ready with a ſpiggot and foſſet towards the bottom, and in this tub put a layer of ſtraw, on which fling your aſhes: Then pour water upon them, and let the aſhes ſoak thoroughly, till the water ſtands above them: Let it thus continue over night; then draw out the foſſet, and receive the lee in another tub, put under the firſt for this purpoſe. If the lee looks heavy and troubled, pour it again on the aſhes; and let it ſettle, till it runs clear, and is of an amber colour. This clarify'd lee put by, and pour freſh water on the aſhes; let this alſo ſtand over night; then draw it off, and you will have a weak lee; which, inſtead of water, pour upon freſh aſhes. The remaining aſhes are of great uſe in manuring of land.

PLATE. III.

p. 80.


A The Tub whereïn ẙ Aſhes are ſoak'd.
B Another Tub to receive ẙ Lees.
C The Iron Cauldren, to boil ẙ Lees in.
D The little Barrel with Lee.
E The Calcar.
E
A
B
C
D
Fig 1.
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2
3
4
5
2
2
2
Pag
92.
Pag 82.

Hulett Sculp

After you have made a ſufficient quantity of lees, pour them into an iron cauldron, brick'd up like a brewing or waſhing copper; but let it not be fill'd above three parts full. On the top of the brick-work put a little barrel with lee; towards the bottom of which bore a hole, and put a ſmall foſſet in, to let the lee run gently into the kettle, in a ſtream about the roundneſs of a ſtraw: But this you muſt manage according to the quantity of lee; for you ought to mind how much the lee in the kettle evaporates, and make the lee in the little barrel run proportionably to ſupply that diminution. Care muſt alſo be taken that the lee do not run over in the firſt boiling; but if you find it will not keep in the kettle, then put ſome cold lee to it, ſlacken the fire, and let all the lee boil gently to a dry ſalt: When this ſalt is cold, break it out of the kettle, put it into the calcar, and raiſe your fire by degrees, till the ſalt is red hot, yet ſo as not to melt: When you think it calcined enough, take out a piece, and let it cool; then break it in two, and if it is thorough white, it is done enough; but if there remains a blackneſs in the middle, it muſt be put in the calcar again, till it comes out thoroughly white. If you will have it ſtill finer, you muſt diſſolve it again, filtrate is, boil it, and calcine it as before: The oftner this is repeated, the more will the ſalt be cleared from the earthy particles, and it may be made as clear as cryſtal, and as white as ſnow; out of which may be made the fineſt glaſs you can deſire.

According to Mr *Merret*'s account, the beſt aſhes here in *England* are burnt from thiſtles and hop-ſtalks, after the hops are gather'd; and among trees, the mulberry is reckon'd to afford the beſt ſalt.

The moſt thorny and prickly plants are obſerv'd to yield better, and more ſalt than others; alſo all herbs that are bitter; as hops, wormwood, *&c.* Tobacco ſtalks, when burnt, produce likewiſe plenty of ſalt. Notwithſtanding this, it is obſerved that fern-aſhes yield more ſalt than any other aſhes.

Another Method.

TAKE pot-aſhes, diſſolve them in a clean earthen veſſel, in river or rain-water; let them ſtand over night, and ſettle; the next day pour off the clear matter, and filter the ſettling through a piece of blanket, in order to get a clear lee: Boil this in an iron kettle, till it becomes a hard maſs; then beat it into pieces, and put it in a calcar to calcine: Diſſolve it again in clear water, filtrate and boil it as before; and the oftner you repeat it, the clearer and finer will be your glaſs: But if it is for colour'd glaſs, once or twice doing it will be ſufficient.

To make the Glaſs Frit.

TAKE white ſilver ſand; waſh it, and ſeparate all the impurities from it, and let it dry, or rather calcine it. Of this take 60 pound, and of prepar'd aſhes 30 pound; mix them well together: Then ſet them in the melting furnace; the longer it is melting, the clearer will the glaſs be made thereof. If it ſtands for two days and two nights it will be fit to work with, or to tinge with what colour you pleaſe. Before you work it, add 40 pound of lead, and half a pound of manganeſe to it. *Or*,

TAKE aſhes, prepar'd as above, 60 pound; of prepar'd ſilver ſand two pound, cryſtalline arſenick four pound, white lead two pound, clear dry ſaltpetre ten pound, borax two pound: mix all well together, and proceed as has been directed, and you will have a beautiful cryſtal. *Or*,

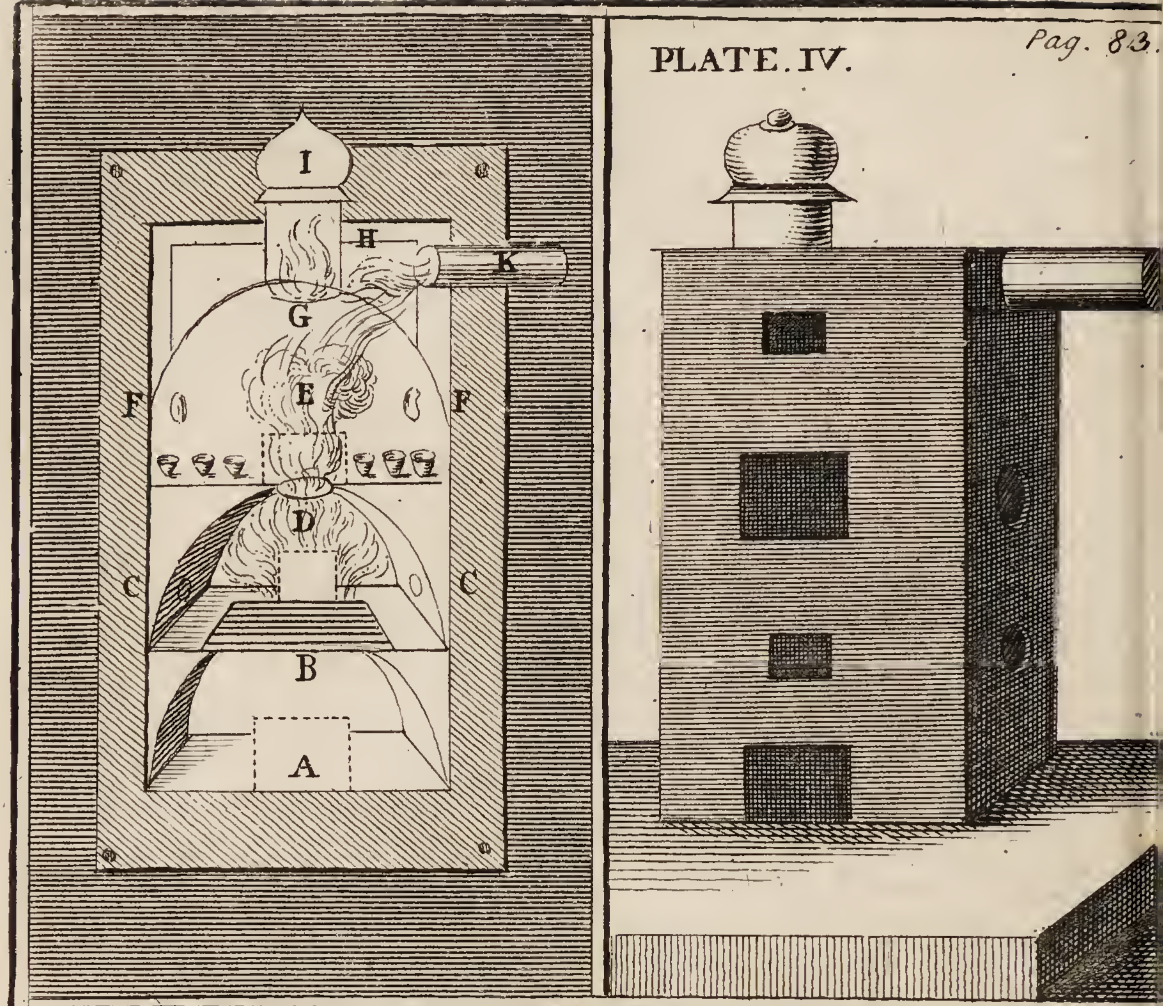
TAKE prepared ſilver ſand 20 pound, clear and dry ſaltpetre 30 pound, borax ſix pound, cryſtalline arſenick eight pound; mix theſe well together, and put them into fuſion for four days; then add two pound of manganeſe, and four pound of borax. *Or*,

TAKE prepared ſilver ſand 38 pound, prepared aſhes 25 pound, arſenick one pound, ſaltpetre two pound, of antimony and borax four pound. *Or*,

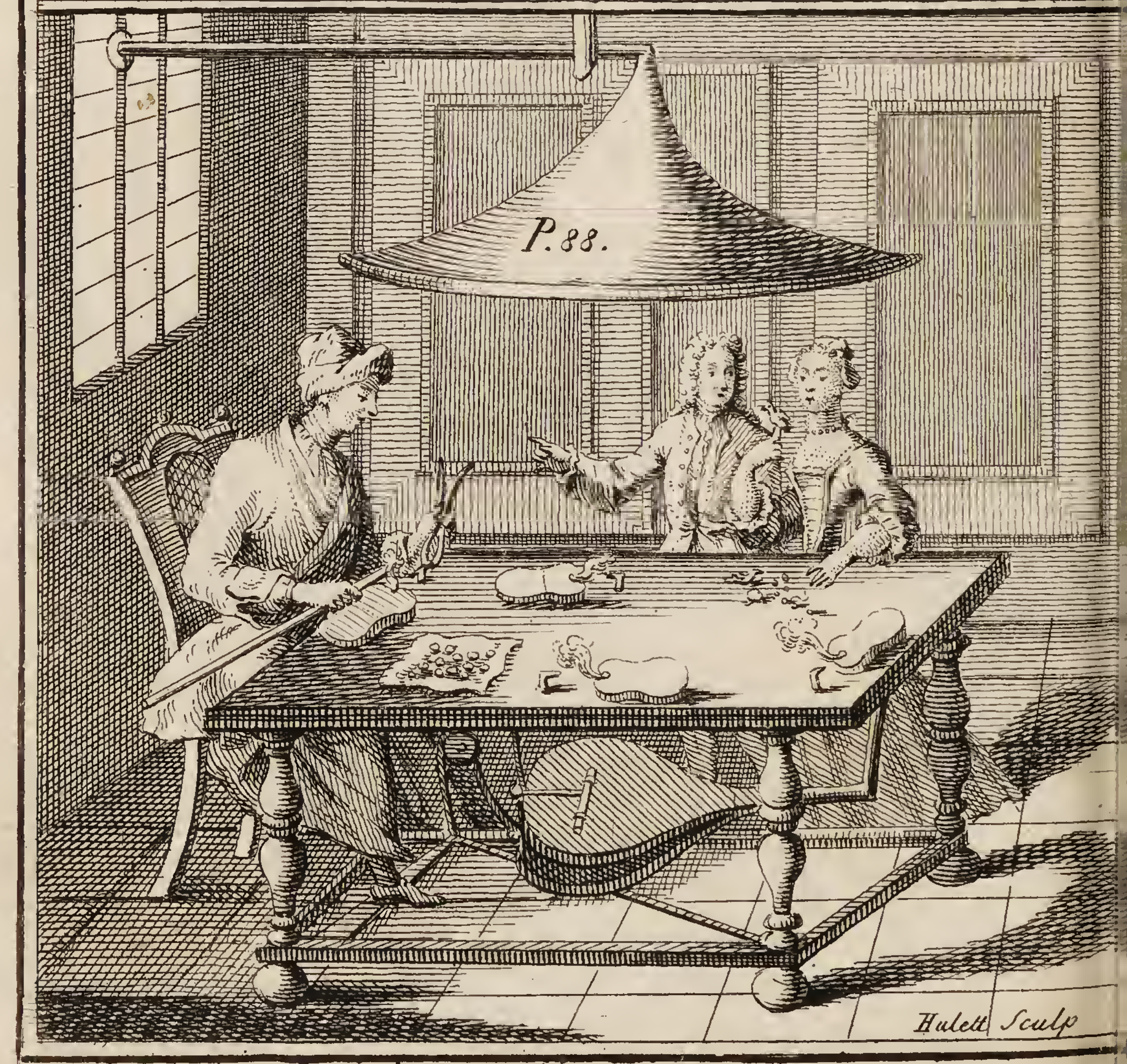
OF prepared ſand, take 40 pound, ſaltpetre 13 pound and a half, tartar ſix pound, arſenick and borax about one pound and a half. *Or*,

PLATE. IV.

Pag. 83.



A Small Furnace for Experiments.



The Art of Blowing Glaſs in Miniature.

PRepared ſilver ſand 10 pound, aſhes ſix pound, tartar three pound, ſaltpetre four pound, lime ſix pound, borax one pound.

How to build a ſmall Furnace, uſeful for Experiments in making of Glaſs, and to ſerve on ſeveral other Occaſions.

YOUR furnace muſt be built according to the ſituation and dimenſion of your room, about a yard ſquare: At the bottom leave a hole, A, which is the receiver of the aſhes, and alſo the drawer of the wind to the fire, which you may make as fierce as you will, by expoſing it either more or leſs to the open air. B, is an iron grate, which is about a quarter and a half above the hole A.

C, Are holes over the grate, wherein you put the fewel; over the grate is a brick'd vault, wherein the flames draw through the hole D, in the upper vault E.

F, Are two or more holes, through which you put the crucibles in; you may make one on each ſide, and make cakes of ſuch clay as the glaſs makers uſe, to ſet them before the holes, and by this means mitigate the flames, which ſometimes may ſtrike too fierce upon the upper vault, and give them a little vent.

G, Is a hole in the upper vault, which may be cover'd and uncover'd as much as you will, and the flame may either go ſtrait through the funnel H, which at the top is provided with the cover I, and which on ſuch occaſions muſt be taken off; or elſe in putting on the cover I, you may convey a reverberatory fire through the funnel K, into another little reverberatory furnace, which will be very uſeful for calcining and preparing ſeveral materials, as may happen to be uſed.

The inſide of this furnace muſt be lined ſmooth, with ſuch potters clay as the glaſs-makers uſe, and two or three inches thick. And having finiſh'd it according to this direction, you may place a good many crucibles in at a time, making the holes through which you convey your larger crucibles higher, ſo that the rim of the crucible may come even with the bottom of the hole, and you may eaſily convey a ladle, ſpattle, or any thing elſe through them. This furnace is the moſt compendious and uſeful, that can be contrived for a novice in the art of glaſs-making.

The

The principal inſtruments that are uſed in making of glaſs, are, 1. A hollow pipe, for blowing the glaſs, with a little wooden handle at top, in order to manage it the beter. Fig. 1.

2. The ſciſſars and ſhears ſerve to cut and ſhape the glaſs. Fig. 2.

3. Iron ladles, whoſe handles at the end are covered over with wood; theſe ſerve to take the metal out of the large melting pot, and to put it into the little ones for the workmen; for ſcumming the metal; to take off the alkalic ſalt; which ſwims on the top, and ſeveral other uſes. Fig. 3.

4. Great and little ſhovels or peels, to take up glaſs; to draw out the aſhes, *&c.* Fig. 4.

5. Several ſizes of forks, to carry the glaſſes, when made, into the upper oven to cool; for ſtirring the matter; for conveying the melting-pots in the furnace from one plate to another, and for other purpoſes. Fig. 5.

General Obſervations on the Art of Glaſs.

1. THE principal ingredients for making of glaſs, are ſtone and ſalt.

2. The ſtone is either *Tarſo*, a ſort of marble brought from *Tuſcany*, and reckon'd by ſeveral artiſts to be the beſt for making of cryſtal glaſs; or black flint ſtones, which in every reſpect are as good. And where theſe are not to be had, clear pebble or white ſilver ſand, will, when rightly prepared, make alſo good glaſs.

3. The next ingredient is ſalt, which, as has been ſaid, is extracted from aſhes, calcined and refined in the niceſt and cleaneſt manner poſſible.

4. Pulverine or rochetta, are aſhes made of certain herbs which grow in the *Levant*, and are amongſt artiſts allow'd to be the fitteſt to extract the ſalt for making of glaſs; of the ſame kind is ſoda which comes from *Egypt* and *Spain*. They prepare theſe aſhes thus: After the herb has been dry'd in the ſun, it is burn'd on iron grates, the aſhes falling through into a pit underneath, made for that purpoſe, where they grow into a hard maſs or ſtone, and are laid up for uſe: but there is no occaſion to fetch the aſhes ſo far, when every country pro-

duces ſufficient of its own growth ; herbs, as well as trees and plants, anſwer in every reſpect the ſame purpoſe.

Pot-aſhes and calcin'd flint, pebble or ſand, will make good glaſs frit, after you have refin'd the aſhes, by firſt diſſolving them in fair water, and after they are ſettled, by boiling the clear lees to a ſalt, then nealing the ſalt in a furnace, diſſolving it again, and proceeding as at firſt, repeating it ſeveral times, till it produces a ſalt as white as ſnow. Of this you may mix three parts to four of calcin'd flint, or as you find it requiſite ; in all which you will become more perfect by practice than by teaching.

5. Glaſs is alſo made of lead, which firſt muſt be calcined ; in doing this, you muſt obſerve that your kiln be not too hot, but only ſo as to keep the lead in fuſion, or elſe it will not calcine. When the lead is melted, it yields at the top a yellowiſh matter, which take off with a ladle for that purpoſe : After the firſt calcination repeat it again, and give it a reverberatory fire, till it comes to a good yellow powder, and is well calcined. Of the calcined lead take ſeven pound, and of the prepared aſhes ſix pound. Care muſt be taken that no ſediment of lead goes into the crucible, but what is reduced to aſhes ; elſe it will make its way through it, bore or rent the bottom thereof, and carry all the metal along with it.

6. Manganeſe, when prepared as directed, is of great uſe to whiten your glaſs; for without it, it will have a green hue ; but by mixing manganeſe with the frit, when melted, by little and little, and then quenching the glaſs in a pail of cold water, repeating this ſeveral times, it will make it of a white and clear colour.

To make Glaſs melt eaſily.

PUT into the melting pot a little of arſenick that has been fix'd with nitre, this will make the glaſs mellow, and eaſy to flux.

To calcine Braſs, which in Glaſs makes a Sky or Sea-green.

BRASS, is copper melted and mix'd with *Lapis Calaminaris*, which not only changes it into a gold colour, but increaſes its weight ; this mixture gives a ſea-green or sky colour to glaſs, when it is well calcined; and to do this obſerve the following rules.

Take braſs plates, cut them into ſmall ſlips, and put them into a crucible, cover and lute it well, and give it a reverberatory fire in a furnace, yet not a melting one; for if it melts, all your labour will be loſt: Let it ſtand in that heat for four days, by which time it will be well calcin'd; then beat it to an impalpable powder, and ſearce it; grind it fine on a porphir-ſtone, and you will have a black powder, which ſpread on tiles, and keep it on burning coals, or the round hole of a furnace, for four days; clear it of the aſhes that have fallen upon it, pulverize and ſearce it, and keep it for uſe. To try whether it is calcined enough, fling a little thereof into melted glaſs, which if it ſwells, the calcination is enough, but if not, then it is either not calcin'd enough, or elſe it is burn'd, and it will not colour the glaſs near ſo well as when the calcination is done to perfection.

To calcine Braſs after another Manner, for a tranſpareut Red Colour, or Yellow.

CUT your braſs into ſmall ſhreds, and lay it *ſtratum ſuper ſtratum* into a crucible, with powdered brimſtone; ſet it on a charcoal fire in a furnace for 24 hours, then powder and ſearce it: When this is done, put it covered into the furnace hole, for 10 hours, to reverberate, and when cold, grind it again very fine, and keep it for uſe.

General Obſervations for all Colours.

1. ALL the melting pots muſt be glaz'd with white glaſs on the inſide, elſe a new earthen pot that is unglaz'd will cauſe the colours to look bad and foul: but the ſecond time of uſing theſe pots they loſe their foulneſs.

2. Obſerve that theſe pots ſerve for one colour only, and may not be uſed for another; for every colour muſt have its own pot, except they correſpond together.

3. Let the powders be well calcined, neither too much, nor too little.

4. Your mixtures muſt be made in due proportion, and the furnace be heated with hard and dry wood.

5. You muſt uſe your colours divided; one part you muſt put in the frit before it is melted, and the other after it is melted and become fine and clear.

To make Glaſs of Lead, which is the fitteſt to be tinctured with moſt Colours.

TAKE of calcin'd lead 15 pound; of rochetta or pulverized cryſtal-frit 12 pound; mix them well and put them together into a melting pot, then into a furnace; and at the end of 10 hours caſt them into water; clear the melting pot of the lead that may remain, and return the metal into it, which after 10 hours heat will be fit to work withal.

How to Work the ſaid Glaſs.

BEFORE you take it upon the iron, raiſe the glaſs firſt in the pot a little, then take it out to let it cool for a ſmall ſpace of time, after which work it on a clean and ſmooth iron plate.

Blue Glaſs.

TAKE four ounces of calcined and pulverized rock cryſtal, two ounces of ſaltpetre, one ounce of borax, half a pound of manganeſe, one pound of indigo-blew.

A Chryſolite Glaſs.

TO one pound of frit, take pulverized verdegreaſe three ounces and a half, red lead one ounce.

A Saphir Green Glaſs.

TO one pound of the above compoſition or cryſtal frit take one ounce of good zaffer, and of curious fine pin-duſt two pound.

To make fine green Glaſs of Tin.

TAKE the filings or ſhavings of tin, nine parts, diſſolve them in aqua fortis, which is made of two parts of vitriol, and three parts of ſaltpetre ; ſweeten the calx with clean ſpring water ; then take 18 parts of nine times or more calcined antimony : Its calcination muſt be repeated 'till it has done evaporating. Both theſe calx melted together, make a fine cryſolite or emerald.

This glaſs will melt upon ſilver, like enamel, and may be uſed on ſeveral occaſions, for embelliſhing ſuch things as are proper for ornaments.

To make a Ruby-colour'd Glaſs.

TAKE well ſettled aqua fortis, made with ſal-armoniac and aqua regis, four ounces ; fling into it by little and little thin bits or filings of tin, one ounce, and let it diſſolve ; Then take the fineſt gold, as much as you will, and diſſolve it alſo in that aqua regis : Take a clean glaſs with clear ſpring water, and pour off the ſolution of the gold as much as you pleaſe into it ; the ſame quantity put alſo to it of the ſolution of the tin, and the water will turn in a moment to a fine roſe colour ; with this water moiſten ſeveral times your glaſs frit, and let it dry ; then proceed as you do with other glaſs in fire ; at firſt it will come out white, but afterwards become a fine ruby.

The Art of blowing GLASS in MINIATURE.

This Art is performed by the Flame of the Lamp in the following Manner.

FIRST, provide yourſelf from the glaſs-houſe with ſeveral pipes of glaſs, that are hollow on the inſide, of ſeveral colours, and different ſizes ; then you muſt have a table, as you ſee repreſenting in the plate annexed. A is the lamp, which is furniſhed with rape or other oil, and a large wick of twiſted cotton ;

cotton; below the table is a pair of bellows, B. When the artiſt treads the treadle faſten'd to the bellows, the wind will be conveyed through the pipes under the table to the ſmall pointed opening by C, directly againſt which is placed the lighted wick of the lamp D. The ſmoak which iſſues forth from the lamp, is conveyed through a broad funnel made of tin or wood E.

The wind which ſtrikes in a ſharp point againſt the flame, occaſions ſuch a violent heat that it will diſſolve the moſt ſtubborn glaſs, and you may, after you have ſoftened the end of your pipe in the flame, blow through the hollow thereof, and form with ſmall plyers and other uſeful tools whatever you pleaſe: Small twiſted nooſes of wire are very convenient to hold your work in, in order to ſhape and join different colours to one peice. The whole art depends chiefly upon practice.

The uſefulneſs of ſuch a table anſwers ſeveral other purpoſes; as, for trying of metal-oar, in this caſe put ſome of it in a hollowed charcoal, &c. and by directing the wind through the lamp upon the oar, the heat will melt it immediately, and ſhew what it contains. In ſoldering it is alſo very convenient; not to mention the conveniency which ſuch a table affords to practitioners in chymiſtry.

How to lay Silver on Glaſs Utenſils, as Plates, Diſhes, Salts Drinking Cups, &c.

TAKE ſilver, what quantity you pleaſe, and beat it very thin, or corn it; then put it into a matraſs, and pour twice the weight thereof of ſpirit of nitre upon it, and you will preſently perceive the ſilver to diſſolve: When you obſerve its ceaſing to work, put your matraſs on warm ſand or aſhes, and it will begin to work afreſh; let it thus ſtand till all your ſilver is diſſolved. After this pour the ſolution out of that matraſs into another, that has a head to it; with this draw off the ſpirit of nitre from the ſolution of ſilver, and let the matraſs remain on the ſand till it is cool; then take it off, and let it ſtand ſtill for 24 hours, and the ſilver will ſhoot into white cryſtals; from theſe pour off the ſolution which remains, and extract from that again the half of the ſpirit; then put it up as before, to cryſtallize, and this repeat, till almoſt all the ſilver is turned into cryſtals; which take out of the glaſs, lay them upon whited brown paper to dry, and preſerve them for uſe. The reſt of the ſilver that remains in the aqua fortis, may be drawn out as has been directed before.

Of this cryſtal take as much as you will, and put it into a retort; pour upon it two or three times its weight of the ſtrongeſt ſpirit of ſal armoniac, lute it well, and put it into a gentle warmth 8 or 10 days to digeſt, and it will contract a blue colour; pour it off, filter and extract in *Balneo Mariæ* almoſt all the ſpirits from it, and there will remain a glaſs green liquid; with this draw over your glaſs, and put it into a glaſs furnace, or into any gentle heat; your glaſs will look as if it were ſilver plate.

But in caſe there ſhould be an overſight, and the ſpirit of ſal-armoniac be too much drawn off, and the ſilver turned to a green ſalt, then pour as much of that ſpirit upon the ſilver again to bring it to a green liquid.

A curious Drinking Glaſs.

TAKE two ſmooth drinking glaſſes, fitted cloſe to each other, ſo that the brims of both may be even; then paint on the inſide of the larger glaſs with oil colours, what you will, either in imitation of moſaick, or any other invention; and when dry, you may with the point of a needle open fine veins or other embelliſhments, *&c.* Then oil it all over with old linſeed oil, and before it is quite dry, whilſt clammy, lay leaf gold upon it, preſs it cloſe down to the glaſs with cotton, and let it dry thoroughly. The mean while take the other leſſer glaſs, and lay a thin clear varniſh on the outſide thereof; and when almoſt dry, lay on leaf gold, and the inſide of the glaſs will look all over gilded. When this is dry, put it into the larger glaſs, and make a paſte of chalk and lac varniſh; with this lute the rims of the two glaſſes, ſo that it may not be perceived, but look as if it were made out of one piece; let it thoroughly dry, and give it another layer of lac varniſh with a fine pencil, and let it dry; then ſmooth it with pumice ſtone, and lay it on a thin varniſh, and when that is almoſt dry, gild it with leaf gold, and give it two or three layers of lac varniſh, and the gold will remain firm.

When inſtead of painting with oil colour you only anoint the inſide of the glaſs with linſeed oil, and then ſtrew it over with ſpangles, and put the inſide glaſs gilded to join, it will have a ſingular beauty. This hint will animate the ingenious to try farther experiments of this amuſing kind.

How to quickſilver the Inſide of Glaſs Globes, ſo as to make them look like Looking-glaſſes.

TAKE two ounces of quickſilver, one ounce of biſmuth, of lead and tin half an ounce each.

Firſt put the lead and tin into fuſion, then put in the biſmuth; and when you perceive that in fuſion too, let it ſtand till it is almoſt cold, and pour the quickſilver into it.

After this, take the glaſs globe, which muſt be very clean, and the inſide free from duſt; make a paper funnel, which put in the hole of the globe, as near to the glaſs as you can, ſo that the amalgama, when you pour it in, may not ſplaſh and cauſe the glaſs to be full of ſpots; but pour it in gently, and move it about, ſo that the amlgama may touch every where. If you find the amalgama begin to be curdly, and to be fixed, then hold it over a gentle heat, and it will flow eaſily again. And if you find the amalgama too thin, add a little more lead, tin, and biſmuth to it. The finer and clearer your globe is, the better will be the looking glaſs.

The Art of Painting upon GLASS.

THIS noble art being the admiration of all who have any tolerable taſte of deſigning or painting, it will not be improper to give the ingenious enquirer after this myſtery ſome few hints, in order, not only to ſatisfy his curioſity with the nature thereof, but alſo, if he is inclined, to lead him into the practice of it; which we ſhall do in the plaineſt and ſhorteſt manner poſſible.

Firſt then, chuſe ſuch panes of glaſs as are clear, even, and ſmooth

2. Strike one ſide thereof with a clean ſpunge, or a ſoft hair pencil, dipt in gum-water, all over.

3. When it is dry, lay the clean ſide of the glaſs on the print or deſign you intend to copy, and with a ſmall pointed pencil, (furniſhed with black colour, and prepared for that purpoſe, as ſhall be directed) delineate the outlines or capital ſtrokes, and where the ſhades appear ſoft, work them by dotting and eaſy ſtrokes one into another.

4. After you have finiſhed your outlines and ſhades in the beſt manner you are able, take a larger pencil, and lay on your colours in their reſpective places; as a carnation in the face, hands, *&c.* green, blue, red, or any other colour on the drapery, *&c.*

5. When you have done this, heighten the lights of your work carefully with an unſplit ſtiff pen, with which take off the colour by way of etching, in ſuch places where the light is to fall ſtrongeſt, and where it is alſo of particular uſe to give the beard or hair a graceful turn.

6. You may lay all ſorts of colours on the ſame ſide of the glaſs you draw your deſign upon, except the yellow; which lay on the other ſide, in order to prevent its flowing and mixing with other colours, and ſpoiling your work.

Neceſſary Obſervations in the baking of Glaſs after it is painted.

FIRST, your furnace for baking painted glaſs muſt be, and is commonly built four ſquare, with three diviſions, as you ſee in the print annexed. The lower diviſion A, is for receiving the aſhes, and for a draught for the fire.

2. The middle diviſion is for the fire, which has an iron grate below, and three iron bars croſs the top, to ſet the earthen pan upon, which contains the painted glaſs.

The third diviſion has the aforementioned bars at the bottom, and a lid at top, in which are five holes for the ſmoak and flame.

3. The earthen pan is made of good potters clay, according to the ſhape and dimenſions of the furnace, about 5 or 6 inches high, with a flat bottom. It muſt be fire proof, and no larger than to have at leaſt two inches ſpace all round, free from the ſides of the furnace.

The figure here annexed will better explain the deſcription.

4. When you are going to bake your glaſs, take quick-lime, which previouſly has been well neal'd or made red hot in a

fierce coal fire: When cold, ſift it through a ſmall ſieve, as even as you can, all over the bottom of the pan, about half an inch thick; then with a ſmooth feather wipe it even and level; when this is done, lay as many of your painted glaſſes as the room will allow. This continue till the pan is full, ſifting upon every layer of glaſs a layer of the mixed powder, very even, about the thickneſs of a crown piece. Upon the uppermoſt layer of the painted glaſs, let the layer of powder be as thick as at the bottom. Put the pan thus filled to the brim upon the iron bars in the middle of the furnace, and cover the furnace with a cover made of potters earth, lute it very cloſe all round, to prevent any vent but what comes through the holes of the cover. After you have ordered the furnace in this manner, and the luting is dry, make a ſlow charcoal or dry wood fire at the entrance of the furnace; increaſe it by degrees, leaſt by a two quick fire the glaſs ſhould be ſubject to crack; continue thus to augment your fewel, till the furnace is full of charcoal, and the flame conveys itſelf through every hole of the cover; Keep thus a very violent fire for three or four hours, and then you may draw out your eſſays, which are pieces of glaſs on which you painted ſome yellow colour, and place them againſt the pan; and when you ſee the glaſs bended, the colour melted, and of a qualified yellow, you may conclude that your work is near done; you may alſo perceive by the increaſe of the ſparklings of the iron bars, or the light ſtreaks on the pan, how your work goes on. When you ſee your colours almoſt done, encreaſe the fire with ſome dry wood, and put it ſo that the flame may reverberate all round the pan; then leave the fire and let it go out, and the work cool of itſelf. Take it out, and with a bruſh clear your glaſs from the powder that may lie upon it, and your work is done,

The colours in uſe for painting upon glaſs, are next to be treated of, and are as follows:

For a Carnation Colour.

TAKE menning one ounce, red enamel two ounces; grind them fine and clean with good brandy, upon a hard ſtone; This if ſlightly baked, will produce a good carnation.

A Black

A Black Colour.

TAKE ſcales of iron from the anvil block 14 ounces and a half; mix with it two ounces of white glaſs, one ounce of antimony, manganeſe half an ounce, grind them with good vinegar to an impalpable powder.

2. Take ſcales of iron one part, and rocaille one part, grind them together very fine upon an iron plate, for one or two days; when they begin to be tough, and look yellowiſh, and clog to the muller, it is a ſign that it is fine enough.

3. Take one pound of enamel, three quarters of a pound of copper flakes, and two ounces of antimony, grind them as before directed.

4. Take glaſs of lead three parts, copper flakes two parts, and one part of antimony, proceed therewith as before.

A Brown Colour.

TAKE one ounce of white glaſs or enamel; half an ounce of good manganeſe; grind them firſt with vinegar very fine, and then with brandy.

A Red Colour.

ONE ounce of red chalk, ground and mix'd with two ounces of ground white enamel and ſome copper flakes, will make a good red; you may try with a little whether it will ſtand the fire, if not, add ſome more copper flakes to it. *Or,*

TAKE red chalk, that is hard and unfit to write withal, one part; of white enamel one part; and one fourth part of orpiment; grind them well together with vinegar, and when you uſe them avoid the ſmoak, which is poiſonous. *Or,*

CROCUS martis, or the ruſt of iron, glaſs of antimony, and yellow lead glaſs, ſuch as the potters uſe, of each an equal quantity; a ſmall matter of ſilver calcined with ſulpher; grind them together very fine, and they will be fit to paint withal, and produce a good red. *Or,* TAKE one half of iron flakes, one half of copper aſhes, one half of biſmuth, a little ſilver filings 3 or 4 beads of red coral, 6 parts of red frit from a glaſs houſe, one half of litharge, one half of gum, and 13 parts of red chalk.

A blue Colour for Glaſs Paint.

TAKE *Burgundy* blue, or blue verditer, and lead glaſs, an equal quantity, grind them with water to a very fine powder, and when you uſe them, lay the flowers that are to be of a blue colour, all over therewith; then raiſe the yellow parts open'd with a pen, and cover them with a yellow glaſs colour; obſerve, that blue upon yellow, and yellow upon blue, always makes a green.

Another Blue glaſs Colour.

BLUE verditer or ſmalt, mix'd with enamel, will make a a good blue paint.

A Green Glaſs Colour.

GREEN rocaille, or ſmall beads of the ſame colour two parts, braſs file duſt one part, menning two parts; grind them together clear and fine, and you will have a good green when it comes out of the pan. *Or*,

ÆS *Uſtum* 2 ounces; menning 2 ounces; fine white ſand 8 ounces: Grind them to a very fine powder, and put them into a crucible; then lute the lid, and give it for one hour a good briſk fire in a wind furnace. After this, draw it off to cool; when cold, pound it in a braſs mortar, adding the fourth part in weight to the powder; grind and mix it well together, and put it into a crucible; then cover and lute it well, and give it a good heat for two hours in a furnace.

A fine yellow Paint for Glaſs.

IT has been found by experience, that the beſt yellow for painting upon glaſs, is prepared of ſilver; wherefore if you would have a fine and good yellow, take fine ſilver, beat it into thin plates, and diſſolve and precipitate it in aqua fortis, as has been directed; when it has ſettled, pour off the aqua fortis, and grind the ſilver with three times the quantity of well burned clay from an oven, very fine, and with a ſoft hair pencil lay it on the ſmooth ſide of the glaſs, and you will have a fine yellow. *Or,*

MELT as much ſilver as you pleaſe in a crucible, and when in fuſion, fling by little and little ſo much ſulphur upon it till it is calcined; then grind it very fine on a ſtone; mix it with as much antimony as is the weight of the ſilver; and when theſe are well ground together, take yellow oaker, neal it well, and it will turn to a brown red, which quench in urine, and take thereof double the quantity above ſpecified; mix it all together, and after you have ground it very fine, lay it on the ſmooth ſide of the glaſs. *Or,*

NEAL ſome thin plates of ſilver, then cut them into ſmall bits, put them with ſulphur and antimony into a crucible; when they are diſſolv'd, pour them into clear water, and thus mix'd together, grind them very fine.

A Pale Yellow.

STratify thin plates of braſs in an earthen pipkin with powder'd ſulphur and antimony, and burn it till it yields no more flame; then pour it red hot into cold water; take it out and grind it fine. Of this powder one part; of yellow oaker, after it is neal'd and quench'd in vinegar, five or ſix parts; let it dry; then grind it on a ſtone, and it will be fit for uſe;

How to deaden the Glaſs, and fit it to paint upon.

TAKE two parts of iron flakes; one part of copper flakes; three parts of white enamel; grind them all together with clear water on a marble ſtone, or upon a braſs or iron plate for two or three days, as fine as poſſible; with this rub your glaſs well over, eſpecially that ſide you draw your deſign upon, and you will finiſh your work much neater.

Some general Obſervations on the Management of Painting and Baking of Glaſs.

FIRST when you lay your glaſs in the pan, let the painted ſide be placed undermoſt, and the yellow uppermoſt.

2. Dilute all your colours with gum-water.

3. Grind the black and red upon a copper plate, other colours you may grind on a piece of glaſs, or a ſtone.

4. Glaſs-colours ready prepared, are glaſs enamel, which is brought from *Venice* in cakes of ſeveral ſorts; alſo the ſmall glaſs beads, that are brought over from *Germany*, eſpecially from *Franckford* on the *Main*. Old broken pieces of painted glaſs are good for that purpoſe, ſo is the green glaſs of potters, and the glaſs drops that run from the ware in the furnace.

5. The colours which are uſed by potters, for painting on earthen ware, may alſo be uſed for painting on glaſs.

A particular Way to paint upon a Drinking Glaſs.

TAKE a ſmall quantity of linſeed, bruiſe it and put it for four or five days in a little canvas bag, in rain-water, and change the water every day; then preſs out the moiſture, and you will have a clammy ſubſtance, like glew; with this grind your colours as uſual, then paint or mark with a pencil, what you pleaſe upon the glaſs, and give it by degrees a thorough heat; with the ſame glew you may alſo gild the glaſs before you put it into the fire.

A fine Gilding for Glaſs.

TAKE gum-armoniac, diſſolve it over night in good white-wine vinegar into another veſſel, and grind the gum-armoniac and a little gum-arabick well together with clear water; when they are well incorporated and fine, then write or draw upon your glaſs what you pleaſe; and when almoſt dry, ſo that it is but a little clammy, lay on your gold, preſs it down with ſome cotton, and let it ſtand over night, rub the looſe gold afterwards with a little cotton gently off the glaſs, and you will ſee the ornaments, figures or writing to that perfection as you deſign'd them; then dry it ſlowly over a gentle heat, increaſing it by degrees ſo as to make it red hot; let it cool of itſelf, and the gold will look fine, and ſtand wind or water.

To Write or Draw upon Glaſs.

TAKE two parts of lead, one part of emery, and a little quantity of white lead, grind them very fine with clear water, then temper them with gum-water, and with a ſoft hair pencil lay it all over the outſide of your glaſs, and when dry, you may with a pen draw or write upon it what you pleaſe; then increaſe the fire from a gentle warmth to make the glaſs red hot; let it cool, and you will ſee your drawing or writing fair upon the glaſs, which will not be deface'd either by cold hot water.

The Art of Glazing and Painting on fine EARTHEN, commonly call'd DELFT WARE.

POTTERS who paint with colours on earthen ware, may be rang'd in the ſame claſs with painters upon glaſs, ſince they uſe almoſt the ſame materials, and in many reſpects, the ſame method.

What has already been ſaid under the foregoing head, is ſufficient, and may ſerve novices in deſigning and painting as an inſtruction to paint flowers, landſkips, figures, or whatever elſe, upon earthen ware. We ſhall however here ſet down ſome receipts that chiefly relate to the glazing of earthen ware, but firſt ſhew,

How to prepare the Clay for fine Delf *Ware.*

TAKE one part of calcin'd flint; one part of chalk, and one part of capital or the cream of clay, mix and work them well to a proper conſiſtence.

To

To prpeare a White Glazing.

TAKE of lead two pound; tin one pound; calcine them to aſhes, as has been directed before. Of this take two parts; calcined flint or pebble, one part; ſalt, one part; mix them well together and melt them into a cake.

The Rotterdam *fine ſhining White.*

TAKE of clean tin aſhes two pound, lead aſhes ten pound, fine *Venice* glaſs two pound, tartar half a pound, and melt them to a cake. *Or,*

LEAD aſhes eight pound, tin aſhes three pound, fine clear calcined flint or pebble ſix pound, ſalt four pound; melt them into a cake. *Or,*

CALCINE eight pound of lead and four pound of tin into aſhes, of theſe take one quart, ſalt and pebble of each one pound, and melt them into a cake.

Another fine White for Earthen Ware.

CALCINE ſix pound of lead, and three pound of tin to aſhes, whereof take two parts, ſalt three parts, pebble or flint three parts, and melt them into a cake.

Another White.

TAKE eight pound of lead and four pound of tin aſhes; among which mix ſix pound of *Venice* glaſs, and a handful of rock-ſalt; melt them into a cake.

A Saltzburg *White.*

TAKK three parts of lead, ſix parts of tin; or ſix parts lead and three parts tin, ſalt three parts, tartar one part, and pebble five parts, *&c.* *Or,*

TALE five pound of lead, one pound of tin, three pound of flint, three pound of ſalt, *&c.* *Or,* TAKE ſix pound of lead, one pound of tin, melt and burn them to aſhes; whereof take 12 ſpoonfuls, 12 of flint, and 12 of fine wood aſhes.

To lay a Ground upon Earthen Ware, on which the White Glaſs will better ſpread.

TAKE calcin'd tartar one pint, flint and ſalt of each one pint, mix them together, and uſe them for a layer or ground over your earthen ware, before you glaze them.

The right Dutch *Maſtirat for White Porcelain.*

TAKE calcin'd pebble, flint or ſand, 100 pound, ſoda 40 pound, wood aſhes 30 pound. This mixture is by the *Dutch* call'd *Maſtirat*; of this take 100 pound, tin and lead aſhes together 80 pound, common ſalt 10 pound, and melt them three times in a cake.

The tin and lead aſhes are made of 100 pound of lead and 30 pound of tin.

The Common Ware is thus Glazed.

TAKE 40 pound of clear ſand, 75 pound of lithrage or lead aſhes, 26 pound of pot aſhes, and ten pound of ſalt; melt them three times into a cake, quenching it each time in clear cold water. *Or,*

TAKE clean ſand 50 pound, lead aſhes 70 pound, wood-aſhes 30 pound, ſalt 12 pound, melt them to a cake.

i With this mixture they glaze fine and coarſe ware, and ſet it in an earthen glazing pan, which is round; the ware is ſet hn them upon three corner'd bars, that go through the like ooles in the pan, and the ware is kept aſunder from touching ne another.

The opening before, is only left in the figure to ſee how the ware ſtand, otherwiſe the pan muſt be entirely clos'd up.

Of

Of Several Colours for POTTER'S GLAZE WORK.

A Fine Yellow.

TAKE red lead three pints, antimony and tin, of each two pound, melt them into a cake, grind it fine, and melt it again. Repeat this ſeveral times, and you will have a good yellow. *Or*,

TAKE 15 parts of lead ore, three parts of litharge of ſilver, and 15 parts of ſand. *Or*,

TAKE eight parts of lithrage, nine parts of calcin'd flint, one part antimony, and a little iron filings; calcine and melt them to a cake.

Fine Citron Yellow.

TAKE ſix parts of red lead, ſeven parts of fine red brick-duſt, two parts of antimony; melt them to a cake.

A Green Colour.

TAKE eight parts of litharge, eight parts of *Venice* glaſs, four parts of braſs duſt; melt them for uſe. *Or*,

TAKE 10 parts of litharge, 12 parts of flint or pebble, one part of *Æs uſtum* or copper aſhes.

Blue Colour.

TAKE lead aſhes one pound, clear ſand or pebble two pound, ſalt two pound, white calcin'd tartar one pound, *Venice* or other glaſs 16 pound, zaffer half a pound, mix them well together and melt them; quench them in water, and melt them again; repeat this ſeveral times: But if you will have it fine and good, it will be proper to put the mixture in a glaſs furnace for a day or two. *Or*, TAKE litharge four pound, clear ſand two pound, zaffer one pound; calcine and melt it together.

TAKE 12 pound of lead, one pound of tin, and one pound of zaffer, five pound of ſand, and three pound of ſalt, tartar and glaſs one pound; calcine and melt it into a cake. *Or,*

TAKE two pound of litharge, a quarter of a pound of ſand, one pound of zaffer, and one pound of ſalt; melt them as directed. *Or,*

ONE part of tartar, one part of lead aſhes, one part of zaffer one part of ſand, and two parts of ſalt; melt it as before.

A Brown Colour.

TAKE of common glaſs and manganeſe or brown-ſtone, of each one part, lead glaſs 12 parts.

A Fleſh Colour.

TAKE 12 parts of lead-aſhes, and one of white glaſs.

Purple Brown.

TAKE lead-aſhes, 15 parts, clear ſand 18 parts, manganeſe one part, white glaſs 15 meaſures, and one meaſure of zaffer.

Iron Gray.

TAKE 15 parts of lead-aſhes, 14 parts of white ſand, five parts of copper aſhes, one of manganeſe, one of zaffer, and one of iron filings.

A Black.

TAKE lead-aſhes 18 meaſures, iron filings three, copper aſhes three, zaffer two meaſures; this, when melted, will make a brown black; but if you will have it blacker, put ſome more zaffer to it.

Brown on White.

MAnganeſe two parts, red lead and white glaſs one part; melt them well together.

A

A fine Red.

TAKE antimony two pound, litharge three pound, ruſt of iron calcined one pound, grind it to a fine powder.

To glaze with Venice *Glaſs.*

WHEN your ware is well dry'd, and ready to bake, ſtrike it all over with white-wine lees; then lay on the *Venice* glaſs (ground fine and mixt with ſalt of tartar and litharge) and bake it as directed.

A Green.

TAKE copper duſt two parts; yellow glaſs two parts; melt them twice. *Or,*

TWO parts of copper filings, one of lead-aſhes, and one of white glaſs; melt them to a cake.

Yellow.

MEnning three parts, brick-duſt two parts, lead-aſhes two parts, antimony two parts, ſand one part, of the above white glaſs one part, well calcin'd and melted. *Or,*

RED lead four ounces, antimony two ounces, melt them to a cake.

Gold Yellow.

TAKE of antimony, red lead and ſand, an equal quantity, and melt it to a cake.

A fine Blue Glaſs to paint with.

TAKE lead-aſhes one pound, clear ſand two pound, ſalt two pound, white calcin'd tartar one pound, flint glaſs half a pound, zaffer half a pound, melt them together and quench them in water; then melt them again and repeat this ſeveral times.

Zaffer finely ground by itſelf, makes good blue, to paint white-glaz'd earthen ware.

A Brown.

ONE part of manganeſe, one of lead, and one of white glaſs.

A Liver Colour.

TAKE 12 parts of litharge, eight of ſalt, ſix of pebble or flint, and one of mangeneſe.

A Sea Green.

TAKE five pound of lead-aſhes, one pound of tin-aſhes, three pound of flint, three quarters of a pound of ſalt, half a pound of tartar, and half a pound of copper duſt.

To lay Gold, Silver, or Copper on Earthen Ware, ſo as to reſemble either of theſe Metals.

MAKE an utenſil of fine potters earth, form and ſhape it thin, neat, and ſilver faſhion; then bake it, and when bak'd, glaze it: But before you bake it again, if you will ſilver, gild or copper it, take a regulus of antimony, melt your metal with it, and beat it to a powder, grind it with water very fine, and glaze it therewith. Then bake it, and when done, the whole utenſil will look like ſilver; for when it comes into the fire, the antimony evaporates and leaves the ſilver, *&c.* behind. But if you will ſilver or gild it only for ornament ſake, and keep it from any wet, then you may lay on the gold or ſilver leaves with brandy, and afterwards poliſh and finiſh it in the beſt manner, after the common method.

PART IV.

Several uncommon Experiments for Caſting in SILVER, COPPER, BRASS, TIN, STEEL, and other Metals; likewiſe in WAX, PLASTER of PARIS, WOOD, HORN, *&c.* With the Management of the reſpective Moulds.

To prepare Clay in ſuch a Manner as to be fit to make all manner of Moulds to caſt Gold, Silver and other Metals in.

TAKE clay, as much as you will, put it into an earthen pot that's glaz'd, and cover and lute it very cloſe, then put it into a potter's furnace, and let it ſtand as long as other earthen ware. After it is burn'd and cold, grind the clay upon a colour ſtone very fine, ſift it through a fine hair ſieve into clear water, and after it is ſettled, pour off the water, and grind the clay once more upon the ſtone, as fine as poſſible; then waſh it again in fair water as before, and ſet it in the ſun or in a warm place to dry.

After this burn'd and waſh'd clay is thorough dry, take thereof three pound, ſal-armoniac two pound, tartar two pound, vitriol one pound; mix them together, and put this mixture into one or two pots, pour upon it about ſeven quarts of clean water, and boil this compoſition for ſome time; then take this water, whilſt it is warm, and mix your burn'd clay therewith to ſuch a conſiſtence that you may form it into balls; lay theſe in a warm place to dry, and when dry, put them into an earthen pot as before, and give them another baking among the earthen ware, and when cold, grind them fine, and that powder will be fit for uſe.

The clay being thus prepared, take ſal-armoniac, put it into a glaſs with water that holds about two quarts, put ſo much of the ſal-armoniac to the water as it will diſſolve over a gentle warmth, and let it ſtand one or two hours cloſed up; then take your powder of clay, temper it with this water to ſuch a conſiſtence as to form it into balls, and make what moulds you pleaſe thereof. When you caſt your metal, you muſt make your mould red hot; and be alſo very nimble in the pouring out your melted metal.

To make Moulds of Clay to caſt Braſs or other Metals therein.

TAKE good clear clay, ſuch as the pewterers uſe; take alſo cloth ſhavings or fine ſhort pluck'd cotton, and fine clear ſand, and if the ſand is not fine enough, grind it on a colour ſtone; mix this with the clay to ſuch a conſiſtence as is fit to make or form your moulds thereof. Your clay muſt not be made ſoft with water, but with ſtrong beer, and when you caſt, let your mould be red hot.

If you would have a fine and ſharp caſt, ſift over your clay ſome fine waſh'd aſhes, before you make the impreſſion.

To prepare Moulds, which need not to be heated, for caſting Metal in them.

TAKE fine ſand, ſuch as the goldſmiths uſe, mix it with lamp-black as much as you think proper; then temper it with rape or linſed oil, fit to make your moulds thereof; whatever you caſt in them, comes not only out neat and ſharp, but you have no occaſion to heat your mould, as is required in other caſes: This you muſt obſerve, that your ſand be very dry before you temper it with the oil.

The Preparation of Mantua *Earth, for Moulds.*

TAKE *Mantua*-earth one part, and one part of charcoal duſt of burnt birch, and one part of ſalt; then mix with it an equal quantity of tartar; boil up the mixture together in a copper pan, and let it ſeeth three times: With this water, which keeps always good, moiſten and temper your earth, ſo as to form it into balls between your hands, and when you would make your mould, roll your earth with a roller, till it is ſmooth and pliable; then you may form it into what faſhion you pleaſe. In this mould you may caſt before it is dry'd; and when you have caſt, take off the earth which is dry'd through the heat of the metal, grind the ſame again, and temper it as you did at firſt to uſe it again.

A particular Sort of Mould, in which one may caſt exceeding fine.

TAKE horſe muſſels, or for want of them, oyſter-ſhells, let them be calcin'd in a potters furnace, then pulverize and temper them with urine: of this make your moulds, and you will caſt very fine and ſharp.

To Impreſs Baſs Relievo or Medals, in Imitation of Ivory.

TAKE of prepared clay one pound, fine plaiſter of paris eight ounces, white ſtarch eight ounces; mix theſe together, and beat up the mixture with the white of ſix or eight eggs, put to it three ounces of clear gum arabick, ſtir it well together to a paſte, and put ſo much of the dry mixture to it, till you knead it like dough; then preſs it into a mould with the palm of your hand, and let it dry in the ſun, obſerving to lay the paſte ſide on a ſmooth board, and it will be clear and hard, like ivory. You may impreſs all manner of medals and curioſities, and make them of what colour you pleaſe.

To Impreſs Medals and other Things in Baſs Relievo, on Paper.

TAKE the ſhavings of ſuper fine white paper, and ſteep it in fair water for ſix or eight days, then put them into a clean earthen pot with water, and boyl them for 2 or 3 hours; this done, take them out of the pot, with as little moiſture as poſſible and ſtamp them in a ſtone morter very ſmall and fine; then put them into a clean linnen bag, and hang that in a veſſel with clean water, changing the water once or twice a week: when you have occaſion to uſe it, take as much as you want out of the bag, ſqueezing the water from it and put it on the mould, preſſing it down gently with a ſpunge, which will ſoak up the water and make the impreſſion more perfect; this being done ſet the mould to dry in the ſun, or in a warm room, and when dry, the impreſſion will come off fair and as ſharp as if caſt in fine plaſter of paris.

To caſt Vegetables in Moulds, peculiarly prepar'd for Silver.

TAKE fine and clear clay or ſpalter, that is dry, and pound it fine in a morter; then take a copper or iron pan, put in your clay, and give it a briſk fire, and after you have heated it thoroughly, take it off and let it cool; then take one part of this clay, one part *Alumen Plumoſum*, grind them together, and caſt the mixture in little tents, which put into a fire to neal; beat it very fine; and when you would form your plant, take one part of this powder, and one part of *Alumen Plumoſum*, grind them together, and add as much of the clay powder as the mixt matter doth contain, and mix and grind them all together. Then take ſome potters clay, to make a coffin round your plant; ſpread it in what manner you think proper, and after the coffin is dry, anoint the inſide thereof, as alſo the plant with good brandy; duſt the before prepared clay and the plant gently through a fine cambrick, and when you have cover'd it all over as thick as it will bear, ſtrike the rais'd coffin a little with your hand or hammer, and the duſt will ſettle cloſer to the plant and make the ſilver, caſt in, come out the ſharper.

After the powder is well ſettled, and your coffin cloſed, cover it fine with dead charcoal, and then lay ſome live ones over them; let the fire gradually deſcend to the coffin, and heat it by degrees to a ſtrong glue, then let it cool of itſelf with the fire; take afterwards fine clay, fine ſand, and ſome wool ſhearings; mix this together, beat and knead it well into one another; then temper it with glue, and fill your coffin with it all over the plant, leaving an opening at the ſtalk for the inlet; then put it again into the fire and make it red hot, and with a pair of bellows, firſt cloſed, draw out the aſhes from the inlet, and it will be ready for caſting.

Then take oil of tartar, which is made of pounded ſalt of tartar, and ſcrape a little ſal-armoniac into it, to give it the ſubſtance of a thin paſte, which is a good flux for ſilver; fling ſome of this upon your ſilver when in fuſion, and it will caſt fine and ſharp.

After it is caſt, anoint the ſilver plant with oil of tartar, lay it on lives coals, neal it, and then boil it in tartar, to which you add a little ſalt, and this will give it a fine bright pearl colour,

A curious Method to caſt all Sorts of Things in Gold, Silver, or other Metals.

FIRST pound plaiſter of paris, or alabaſter, to a fine powder, ſift it through a cambrick, or very fine hair ſieve, and put it into an iron pan, over a clear coal fire; ſtir it about till it begins to boil, and bubble up like water; keep it ſtirring; recruit your fire, and continue this till you find it ſo thick as not to be able to draw it along with your ſtick; then pour it into a bowl and let it cool.

Take alſo brick-duſt finely powdered and ſifted.

The miners find ſometimes a matter in the iron mines, which they call liver oar; take this and waſh it from the coarſer ſand, and when dry, put it into an earthen pot, cover it, ſet it to neal thoroughly, and when cold, pound and ſift it. When it is right burnt, it will be of a copper colour; put all theſe different powders into ſeveral boxes, and preſerve them from duſt and ſoil, for proper uſe.

To caſt Vegetables and Inſects.

FOUR parts of the above plaſter of paris, two parts brick-duſt, and two parts liver oar; mix them well together, and ſift them through a fine hair ſieve, and when you are ready to form your moulds, pour clean water to them, ſtir them well together to the thickneſs of a thin paſte; but you muſt be pretty nimble with this work, elſe it will harden under your hands, and be of no uſe.

The Mould you prepare thus:

TAKE the plant you deſign to caſt, and ſpread the leaves and ſtalks ſo as not to touch one another; then make a coffin either of lead or clay, put your plant in it, ſo as not to touch the coffin; at the bottom you may lay a piece of paper, to keep the ſtuff from ſticking to the board, but let your ſtuff be neither too thick nor two thin, for if it is of a right conſiſtence it will force itſelf cloſe to the plants, and come out ſharp; let the ſtalks be carefully kept up for the inlet; and when you pour this ſtuff upon your plants, do it gently, and ſeparate thoſe leaves which might lie cloſe to one another, with a needle, pouring all the while, to make the mould the ſtronger.

After this is harden'd, put it in a dry place, and keep it till you have ſome more ready to caſt, but you muſt ſecure it from froſt.

If you would caſt inſects, or any ſmall animal or reptile, put them in what poſition you will upon a little board, brown paper, or paſte-board, which firſt muſt be anointed with oil in order to make the plaiſter ſtuff come off the eaſier; about your inſect make a little coffin, and if you can raiſe the inſect ſo as to be free from the board or paper, it will be the better, which you may do by tying it with two or three hairs, faſtening them at the top of the coffin, and by this means it will hang in the middle thereof; when this is ready, pour as before directed, your plaiſter gently upon it, and after the mould is a little dry, it will be fit for uſe.

If you lay your inſect or other creature upon the paper, you muſt make a wall about and caſt your plaiſter upon it; let it ſtand a little, and when dry, take off your wall, and cut the plaiſter round about the inſect; and taking the mould off the paper, there will be an opening at the bottom of the mould where the inſect lies; turn this mould and anoint it about the opening and the part on the inſect with oil; then caſting ſome freſh plaiſter upon that plate, your mould will take aſunder, and be very convenient to draw out the aſhes of the inſect, after it has been burn'd as is here directed.

Put your mould upon ſome warm wood-aſhes, then cover it with ſmallcoal, over the ſmallcoal lay charcoal, and then fling ſome lighted ſmallcoal over them to kindle the others ſo that the heat may be gently convey'd to the mould; and after it has glow'd ſome time, and you think the inſect or plant is conſum'd to aſhes, let it cool of itſelf with the fire about it, to hinder the air coming to it. When your mould is cold, open the hole for the inlet, and either with your breath, or with a little hand ſpout that is moiſt, draw out the aſhes, and your mould is ready.

You may alſo burn thoſe moulds in a muffel, if you cloſe the muffel to prevent the air coming in, and lay the coals on, and glow it as has been directed. After you have taken out the mould, put the ſame in warm ſand, and having your ſilver or other metal ready melted, pour it in quick, but if you caſt ſilver, fling into the flux a little ſal-armoniac and borax, mix'd together. After it is caſt, let the mould cool a little, then quench it in water, and the plaiſter will fall off of itſelf, bruſh the ſilver clean, and neal and boil it as has been already directed.

To caſt Vegetables or Inſects in another Manner.

TIE your plant, ſprig, or inſect with a fine thread to a little ſtick, dip either of them into brandy, and let it dry a little, then temper your plaiſter of paris, prepared as before directed, with water of ſal-armoniac, pretty thin, and dip your plant or inſect in it all over, then put the little ſtick in the hole againſt a wall or any thing elſe, let it hang free, and in the drying you may diſplay the leaves of the plant or the legs of the inſect as you would have them, and when you have done this hang it in the coffin, the little ſtick may reſt on each end of the coffin, then pouring your plaiſter over, you will have an exact mould, then proceed as directed before.

If you would have a ſmall inſect to ſtand upon a leaf, then dip the ends of its legs in turpentine, and put it on the plant before you dip it: If it is a ſpider or graſshopper, or any other inſect which you think will be too ſtrong for the turpentine, kill it firſt in vinegar, and after that put its legs in the turpentine, and fix it to the leaf of the plant.

To caſt Figures or Medals in Brimſtone.

MELT (in a glaz'd pipkin) half a pound of brimſtone over a gentle fire, with this mix half a pound of fine vermillion, and when you have clear'd the top, take it off the fire, ſtir it well together, and it will diſſolve like oil; then caſt it into the mould, after being firſt anointed with oil, let it cool, and take it out; but in caſe your figure ſhould change to a yellowwiſh colour, you muſt only wipe it over with aqua fortis, and it will look like the fineſt coral.

How to form and caſt all Manner of ſmall Birds, Frogs, Fiſh, &c.

TAKE an earthen, iron or tin ring, which is high and wide enough to hold the animal you deſign to caſt, and ſet a ring upon a clean board or paſte-board; then lay the animal upon it, and caſt the fine mixture of plaiſter pretty thick over it, the reſt of the vacancy you may fill up with a coarſer plaiſter, even to the brim: When this is done and pretty well dried, turn your ring, and putting a little ſhort ſtick cloſe to the body of the animal, caſt a cruſt on that ſide, to cover that part which lay cloſe to the board, and when dry, burn it, and go about the caſting as directed: After you have burn'd or glow'd it thoroughly, you muſt draw the aſhes out of the hole which is made by the little ſtick, and this you may uſe for your inlet.

How to caſt Small Shot.

MELT your lead in a ladle, then pour it gently in a continual ſtream into a pan or pale of water, on the ſurface whereof ſwims oil of a finger thick, and you will have good round ſmall ſhot.

HOW to cak Images of PLAISTER of PARIS, likewiſe how to caſt WAX, either ſolid or hollow; alſo how to form Images in WAX, and and caſt them afterwards in any Metal, either ſolid or hollow.

THE preparing the Mixture for the moulds has been before ſhewn, for which reſaon it is needleſs to repeat it here again.

If you will make a mould to caſt an image or animal in, take clean potters clay, make thereof a coffin round about the image, which you lay long-ways on a board, and anoint it over with oil; then take fine plaiſter of paris, mix it with water, and pour it all over the image, ſo that it may cover it every way; then give it a ſtronger coat with a coarſer ſort, and when the plaiſter is dry, take off the coffin, and cut that ſide which is caſt ſomething flat, making ſome notches or marks upon it; then turn it, and make a coffin about it again, and caſt that ſide of the image, after you have anointed it with ſome oil all over, ſo that the whole may be entirely incloſed.

After the plaiſter has been a day or two upon the image, it will be quite dry; then with a wooden mallet beat cautiouſly againſt the plaiſter, 'till a piece thereof looſens, which being taken off, the reſt will come off eaſy; and after you have diſmantled the whole, anoint the inſide thereof with linſeed oil, with a fine hair pencil bruſh, and let it dry in; this do twice, and after they have lain two or three days, cut in an inlet, where you think it moſt convenient, and when you will caſt with plaiſter of paris, before you do it, anoint the inſide of the mould, and after you have put all the pieces in their proper places and tied them together, caſt your plaiſter, and let it ſtand half a day; take the pieces one after another carefully off, in order to keep the image intire; but if you will caſt wax in that mould, put only the mould for half an hour before in water, and the wax will not ſtick to it. If you will have the image hollow, then mind that the wax be not too hot; pour it into the mould, and you will eaſily ſee how thick it ſticks to it. When you think it is thick enough, then turn your mould about, and pour out the wax that's remaining, and after you have for a little while laid it in water, take off the pieces of moulding, and you will have the image done to perfection. You muſt obſerve, that before you break the mould from the image on which you formed it, you muſt mark it all over with croſſes, circles or ſtrokes, by which you may afterwards fix them right and exactly together to caſt again. If you will have the wax figures ſolid, then let the mould with the images lay for half an hour or more to cool in fair water.

To prepare the Wax.

TAKE one pound of white roſin, that is not greaſy, two pound of wax, melt the wax, ſtrain it through a cloth into a glaz'd pan, and ſtir it about till it is cool.

To caſt Medals and other Things in Baſs Relievo.

LAY your medal on a clean piece of paper, or a clean board, incloſe it with a wall of clay or wax, then pour the plaiſter of paris half an inch thick upon it; when it is dry, take off the mould, and anoint it with clear ſallad oil, two or three times, both within and without. If you will caſt plaiſter of paris, lay the mould firſt for a quarter of an hour in clear water; then caſt your plaiſter as thick as you pleaſe.

You muſt obſerve, that whenever you make a mould of plaiſter, let it be for baſs relievo or figures, you muſt always anoint it with oil, two or three times, which will not only preſerve them from the damage they otherwiſe would ſuſtain from the water, but make the caſt pieces come out clear.

Medals and Figures in Baſs Relievo, how to caſt them like Jaſpis.

TO do this, you muſt have a hand-ſpout, or a glyſter-pipe, at the end whereof fix a tin or iron plate, full of round holes, ſome larger than others. In this ſpout put a paſte, made of fine chalk of ſeveral colours; then force them out in ſmall ſhreds of mixed colours in one piece, cut them with a fine edged knife in thin round ſlices, and put one into your mould, preſſing it down gently; then pour the plaiſter of paris upon it, and when dry, lay it firſt over with fiſh glue, and after that varniſh it, and it will be of ſingular beauty.

The colours you may firſt dilute with gum-water, before you mix the chalk with them.

Another.

TAKE the abovementioned chalk-paſte, and after you have mixed therewith a variety of colours, as ſmalt, white lead, vermillion, red lead, maſticot, verdegreaſe, brown red, &c. and formed each colour ſeparate into little cakes, then (with a rolling pin) ſpread them like pye-cruſt, and when you have done as many colours as you think proper, lay one leaf upon another, roll them together from one end to the other, and with a knife cut ſlices as thin as a wafer; take theſe and cover your mould with, preſs it cloſe down with your thumb, and pour the plaiſter of paris over it; when dry, do it over with fiſh-glue, and then varniſh it, or give it a poliſh with a dog's tooth.

To caſt Fiſh, Reptiles, Fruit, or any kind of Things, in a Pewter Plate or Diſh.

TAKE a pewter plate or diſh, garniſh the ſame with either fiſh, reptiles, fruits, plants, *&c.* Diſpoſe them in proper order, as your fancy directs you. Small animals or leaves of plants faſten to the diſh with a little turpentine, and when every thing is in order, wall it round; then pour your plaiſter of paris over it; ſtrike upon the table the diſh ſtands on, in order to make the caſting fix the cloſer about the things; after the plaiſter is dry, make the mould for the back part of the diſh; glow it, in order to burn the things to aſhes, and having cleared your mould, fix them together for caſting, then tie them round with wires, and make them red hot, caſt your pewter; and in order not to make the diſh too heavy, convey ſome little openings from the back part of the mould to the body or hollow of the animals, ſtopping the outſide cloſe up again, till your caſting is over, and when you think the pewter ſufficiently fix'd, then open theſe conveyances and pour out the pewter which may remain in the ingot melted.

If you would caſt it in ſilver, then model your leaves, animals, *&c.* each ſeparate and hollow, that they may be afterwards ſoldered on.

To caſt Figures in Imitation of Ivory.

TAKE izing-glaſs and ſtrong brandy, make it into a paſte, with the powder of very fine grounded egg-ſhells. You may give it what colour you pleaſe; but caſt it warm into your mould, having oiled it all over; leave the figure in the mould 'till cold; then ſet them in the air to dry, and you will have them reſemble ivory.

Another.

TAKE a ſufficient quantity of egg-ſhells, put them into an earthen Veſſel, lute it well, and let them be put in a potters furnace, and they will burn to white calx, if after the firſt burning they are not white enough, then burn them a ſecond time; then with parchment glew, mix it into a maſs fit to be caſt in moulds, wherein let them dry. If you will have your figures of different colours you muſt colour your glew, for red with braſil, for geen with verdegreeſe, *&c.*

Another Mixture to caſt Figures in Baſs Relievo.

TAKE flower of chalk, finely ground, mix it with clear glue well together, pour it into your mould, preſs it with the palm of your hand, and it will come out very fine: you may do this in what colour you pleaſe.

To caſt with marbled Colours in Plaiſter.

TAKE ſeveral colours, as vermillion, *Dutch* pink, yellow oaker, ſmalt, *&c.* temper them with water, and mix every one apart with plaiſter: Then take what colours you pleaſe, and firſt ſprinkle your mould, which is beſt of brimſtone, with one or more of them, with a little pencil or feather; then pour a colour different from what you ſprinkled into the mould, and after it is hardened, give it a gloſs with wax or varniſh, as pleaſes you beſt.

A Sand in which one may caſt Things to the greateſt Nicety, whether flat or in Baſs Relievo.

TAKE fuller's earth, put it into a reverberatory furnace, ſo long till it is red hot; then take ſal armoniac about one pound, diſſolve it in two quarts of water; with this water moiſten the burnt earth, and when cool, put it into the furnace in a red hot pan: after it has glown there, take it out again, when the heat is a little over, ſprinkle it with the above water again, till it is quenched, then give it another fire, and repeat this five or ſix times, the more, the better it will receive the metal; then grind it to a very fine powder; put it into the frame, which may be either of braſs, iron or wood, but firſt moiſten it a little with the aforeſaid water; then make your impreſſion near the ingot, and having dried it before the fire, while it is hot, caſt your metal; the mould or impreſſion will be better the ſecond than the firſt time uſing it, but every time you uſe it, make it firſt red hot.

To make Horn ſoft.

TAKE one pound of wood-aſhes, two pound of quick-lime, one quart of water; let it boil together to one third; then dip a feather into it, and if in drawing it out the plume comes off, it is boiled enough, if not, let it boil longer; when it is ſettled, filter it through a cloth; then put in ſhavings or filings of horn, let them ſoak therein three days, and anointing your hands firſt with oil, work the horn ſhavings into a maſs, and print, mould or form it in what ſhape you pleaſe.

To caſt Horn into Moulds.

TAKE horn ſhavings as many as you will, and lay them in a new earthen pot; take two parts of wood-aſhes, and the third part of lime, pour clear lee upon it, ſo as to cover it all over, boil it well, ſtir it with an iron ladle, till it has the conſiſtence of a paſte; If you will have it of a red colour, then take red lead, or vermillion, as much as you think proper, and temper it with the paſte; then caſt it into a mould, and let it dry; and you may ſmooth it with a knife, and it will be of one ſolid piece; you may in this manner bring horn, to what colour you will have it.

To caſt Wood in Moulds, as fine as Ivory, of a fragrant Smell, and in ſeveral Colours.

TAKE fine ſaw-duſt of lime-tree wood, put it into a clean pan, tie it cloſe up with paper, and let it dry by a gentle heat; then beat it in a ſtone mortar to a fine powder, ſift it through a cambrick, and lay it, if you don't uſe it preſently, in a dry place, to keep it from duſt.

Then take one pound of fine parchment glue, the fineſt gum dragant and gum-arabick, of each four ounces; let it boil in clear pump-water, and filter it through a clean rag; then put into it of the ſaid powder of wood, ſtir it till it becomes of the ſubſtance of a thick paſte, and ſet it in a glaz'd pan in a hot ſand, ſtir it well together and let the reſt of the moiſture evaporate till it be fit for caſting. Then pour or mix your colours with the paſte, and put in oil of cloves, of roſes, or the like, to give it a ſcent; you may mix it if you will, with a little beaten amber: For a red colour uſe braſil ink, and for other colours, ſuch as will be directed under the article for book-binders. Your mould will be better of pewter or braſs, than of plaiſter of paris; anoint it over with oil of almonds, and put your paſte into it, let it ſtand three or four days to dry and harden, then take off your mould, and it will be as hard as ivory; you may cut, turn, carve, and plane it like other wood; it will be of a ſweet ſcent; you may, if your mould will allow it, uſe ſeveral colours in one piece, leaving only in ſome part the natural colour of the wood, in order to convince the beholder what it is. It is a fine and curious experiment.

Of the Mixture for caſting MIRROURS, and other Things for OPTICKS.

WE find the method for preparing theſe mixtures preſcribed by ſeveral authors, but after different ways; wherefore I ſhall ſet down only a few, which for the generality are beſt approved of: And firſt,

TAKE three pound of the beſt refined pewter, and one pound of refined copper. Firſt melt the copper, and then add the pewter to it; when both are in fuſion, pour it out, and when cold beat it to powder: Then take 12 ounces of red tartar, a little calcined tartar, three ounces of ſaltpetre, one ounce and an half of alum, and four ounces of arſenick: Mix and ſtir this together, and after it has done evaporating, pour out the metal into your mould; let it cool, and when poliſhed you will have a fine mirrour.

This is the compoſition which is commonly call'd the ſteel mixture.

Some artiſts will have the arſenick omitted, becauſe it is apt to turn the mirrour into a deadiſh blue colour, and requires new poliſhing every time one wants to uſe it, and they think that copper and pewter are ſufficient to anſwer that purpoſe.

Another.

TAKE an earthen pan, that is not glaz'd, and has ſtood the fire; put into it two pound of tartar, alſo the ſame weight of cryſtalline arſenick, and melt it on a coal fire. When this mixture begins to ſmoak, add to it 50 pound of old copper, and put it into fuſion for ſix or ſeven hours, ſo that it may be well cleanſed. Then add to it 50 pound of pewter, and let them melt together; after this take up ſome of the mixture with an iron, to ſee whether it is too hard and brittle; if ſo, then add a little more tin, and when you have the right temper, fling four ounces of borax over it, and let it ſtand in the furnace till it is diſſolv'd; then pour it into your mould and let it cool; when it is cold, rub it firſt with brimſtone, and then with emery; and after the ſurface is made ſmooth and even, poliſh it with tripoly or tin aſhes, and give it the finiſhing ſtroke with lamp-black. *Or,*

TAKE copper one part, pewter three parts, and a very little arſenick or tartar; when theſe are put into fuſion let them incorporate.

Some take of copper three parts, of pewter one part, and a little ſilver, antimony and white flint.

Others do it with one part of lead, and two parts of ſilver.

After the metal is form'd and caſt, it is requiſite to have it ſmooth and well poliſh'd: The firſt is done with emery, then with powder of brimſtone or tin aſhes, or elſe with tripoli: The poliſhing is done with pulveriſed chimney ſoot (of wood fires) and the aſhes of willow or cedar, which will give it a fine luſtre. The emery is ground to a fine duſt, and moiſten'd with water. *Or,*

STEEL mixtures are alſo made out of one pound of pewter, and one third of copper: When theſe are melted add two ounces of tartar, and one ounce of orpiment, and when evaporated, pour the mixture out into the mould. The caſting of flat mirrour or looking-glaſs is done upon a flat board, which muſt be made dry and warm, and cover'd with roſin or pitch; by this means the mirrour is fix'd to the broad: When cold, rub it with ſand and water, then with emery or flowe of brimſtone, and at laſt poliſh it with tin-aſhes.

Another Sort of Steel Mixture for Mirrours.

TAKE good new copper, of that ſort which is uſed for copper wire, eight parts; fine *Engliſh* pewter, one part; biſmuth five parts; put it together in a crucible and melt it. Then greaſe your mould all over with tallow, in order to caſt your metal into it; when it is in fuſion, dip a hot iron into it, what ſticks to it, let cool. If the colour is inclining to white, it is right; but if to red, you muſt add ſome more pewter, till it has its right colour. Obſerve, that whatever you put to the melted metal, muſt firſt be made hot. After this manner you may form and caſt whatever you pleaſe. *Or,*

MELT one pound of copper, fling into it eight ounces of ſpeltar, and when the ſpeltar is in flame, ſtir it with a ſtick or iron rod well together: Then add five or ſix ounces of fine pewter to it; pour it into your moulds, ſmooth and poliſh it as has been directed above, and you will have a fine and bright mirrour.

Peter Shot's *Metallic Mixture for Mirrours.*

TAKE ten parts of copper, melt them and add four parts of fine pewter; ſtrew upon the mixture a ſmall quantity of pulveriſed antimony and ſal-armoniac; ſtir it well together, till the ſtinking ſmoak is evaporated: Then pour it out into the moulds, and firſt ſmooth it in ſand and water, and then proceed as has been directed.

Theſe mixtures for mirrours are made different ways; the copper is the chief ingredient, which muſt be tempered with a whitiſh metal, in order to bring the objects that are ſeen therein, to their natural colour; and this is done by pewter and arſenick.

To caſt a flat looking-glaſs, it will be beſt to have two flat poliſhed ſtones for a mould; between theſe two ſtones put on each end an iron wire, as thick as you would caſt your mirrour; then tie or ſcrew them cloſe, and fill the openings round about with putty, leaving only an opening to pour the metal in. When that is dry and made thorough warm, pour the metal in; and when it is cold, ſmooth and poliſh it as directed above. You may faſten the one ſide to a flat ſtone with plaiſter of paris, and poliſh the other with a ſmooth ſtone? and laſt of all, give it the finiſhing ſtroke with a piece of old hat, and fine tin aſhes.

If you would caſt a concave mirrour, or burning glaſs, let your mould be exactly turned; but if you cannot get it conveniently done, you may take a round ball or bowl, and proceed thus:

Make a cruſt of wax, roll it with a roller to what thickneſs you would have your metal caſt; and to have it of an equal thickneſs, you may fix a couple of rulers on each ſide for your roller to play upon; Then cut this cruſt of wax into a round circle, and form it cloſe to your bowl, and ſet it in a cool place to harden. In the mean time prepare a fine clay, by waſhing and pouring it out of one pan into another; take the fineſt of the ſettling, and get it burnt in a potter's furnace to a reddiſh colour. When this is done, grind it with ſal armoniac, ſublimate and rain water, upon a marble very fine, and to ſuch a conſiſtence, that it may be laid on with a pencil like painters colour: With this paint one ſide of the wax mould over, and let it dry in the ſhade; when dry lay on a ſtronger coat of haired clay, of about two fingers thick, and let this alſo dry in the ſhade. Then lay the concave ſide uppermoſt, and do as above. Firſt, with a ſoft haired pencil paint the prepared and burnt clay all over, and when dry, lay it over with hair'd clay, ſo as to cover the whole mould of wax; the place where you deſign to caſt your metal, you may open after it is dry. Then fix the mould, with the hole downwards, upon a couple of iron bars, or a couple of bricks making a charcoal fire underneath and round the ſides of it, that the wax may melt and run out at the hole: You may catch ſome of the wax, and ſet it by for other uſes. When thus the mould is cleared of the wax, and is ſtill hot, turn it up and put warm ſand round about it to the top, to keep it firm; then put an earthen ware funnel into the hole, and pour in the metal; as ſoon as you begin to pour, fling into the metal a little rag dipped in wax, and whilſt it is in flame, pour it out into your mould: After the metal in the mould is cold, poliſh it carefully, ſo as to take no more off in one place than in another, which if you do, will prove a detriment to the mirrour

The poliſhing is beſt done after the braſiers manner, *viz.* with a wheel, to which is fixed a rough ſand ſtone, to take off the coarſe cruſt; then with a fine ſtone and water, make it ſmooth, and with a wooden wheel, covered with leather, and laid on with emery, poliſh it from all the ſtreaks or ſpots, giving it the finiſhing ſtroke with fine tin-aſhes and blood ſtone, which you apply to the wheel that is covered with leather: Continue this ſo long till it has a perfect gloſs. Keep it in as dry a place as poſſible, to prevent its tarniſhing; but if it ſhould tarniſh, you muſt poliſh it again with a piece of buckskin, dipped in fine waſhed tin aſhes. After the ſame manner you may alſo poliſh the concave ſide of the mirrour.

An uncommon Art of preparing a Mirrour Mixture on Braſs.

TAKE ſtrong diſtill'd white wine vinegar, one pound; fine ſal armoniac, four ounces; quickſilver, four ounces: Let this boil upon a hot ſand, till the third part of the vinegar is boil'd away; this liquor is the principal ingredient for the work: Then take a braſs plate, poliſh it very bright with ſome coal duſt, lay it in an iron pan on a gentle coal fire, and when it is pretty hot, dip a rag into this liquor, and rub your plate with it for an hour together; this lays the foundation for what follows; Make a paſte with one part of quickſilver, and two parts of ſoap-tin; in this dip your rag, and rub it upon the plate of braſs, till you have a looking glaſs colour.

Theſe plates, thus prepared, lay in the iron pan upon a coal fire, till you ſee they begin to turn to a reddiſh colour, which they will do in about a minute's time; with this colour the mercury flies away, and the tin colour remains on the plate; then let it cool, and take a little prepared emery upon a piece of leather, and rub the plate over with even ſtrokes, but not too long, for fear of rubbing with the emery the tin from the braſs. You may inſtead of emery poliſh it alſo with tripoli.

N. B. If the tin ſhould make the plate too white, you my uſe lead inſtead thereof, making a paſt with that and mercury, and proceed as above.

By this means you may make what figures you pleaſe.

To Caſt Iron.

TAKE clean filings of iron, waſh them in lee, and then in water; mix them with as much powder of ſulphur, put the mixture into a crucible, and give it a ſtrong fire, till it is in fuſion: If you manage it right, it will caſt clean and ſmooth.

To Caſt Steel.

TAKE of the beſt and fineſt ſteel, about one pound; break it into bits, put it in a good ſtrong crucible, and neal it to a bright red colour. Then add 16 or 24 ounces of good common ſteel, and neal it thoroughly: Add then 8 or 10 ounces of * *Arſenic Glaſs*, give it a violent fire, and it will melt and flux; with this compoſition you may caſt what you pleaſe.

To Caſt Iron as white as Silver.

TAKE tartar, ſaltpetre, arſenic, and clear ſteel filings, of each an equal quantity; put them together into a crucible, on a charcoal fire; when in fuſion, pour the mixture out into an ingot, and you will have out of one pound of ſteel filings about two or three ounces of a white bright maſs; clear the top of the droſs, and preſerve the maſs for uſe.

Another Method.

TAKE tartar, oil, and a little fix'd ſaltpetre, and mix this into a paſte; then put iron or ſteel filings into a crucible, ſet it on a charcoal fire, fling the mixture upon it, and it will diſſolve and come out like ſilver; but it is brittle, and apt to break. *Or,*

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* *To Prepare the Arſenic Glaſs*: Take one pound of white arſenic, two pound of good ſalt-petre; put it into a new pot, that is not glaz'd with a cover that has a little round hole in the middle; lute it well all round, then let it dry, and when dry put the pot in a reverberatory fire for three hours and there will evaporate out of the hole of the cover

TAKE calcin'd tartar, and mix it with oil; of this take two ounces, ſteel filings ſix ounces; put them together into a luted crucible, and ſet them in a wide furnice, till you think they are melted; Then open the crucible, and make a fierce fire till you ſee the mixture riſe: Then take it off the fire, clear it from the droſs, and caſt it into an ingot of what ſhape you pleaſe, and it will be of a white colour.

How to Caſt Pictures with Iſing-glaſs, on Copper-plates.

TAKE fine white iſing-glaſs, as much as you pleaſe, cut it fine, and put it into a glaſs or cup, pour on it ſo much brandy as will juſt cover the iſing-glaſs; cloſe it well, and let it ſoak all night; then pour ſome clear water to it, and boil it on a gentle coal fire, till a drop of it, put on a knife, is like a clear cryſtalline jelly; ſtrain it then through a cloth, and put it into a cool place; where it will turn to a jelly and be ready for uſe.

When you are about caſting a picture, cut ſo much of the jelly as you think you have an occaſion to cover the copper plate with; diſſolve it in a clean pipkin, or ſuch like utenſil over a ſlow coal fire, and mix any of the colours to be hereafter mentioned amongſt it: mean while your copper plate muſt be clean, to rub the muſhel gold or ſilver into the graving with a hair pencil; then wipe the plate carefully with clean hands, as the plate printers do, and when this is done, pour your diſſolved iſing-glaſs over it, but not too hot, ſpreading it with a pencil very even every where, till your copper plate is covered: ſet it then in a moderate warm place to dry, and when you perceive it thorough dry, then, with the help of

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cover a red poiſonous fume; which, you muſt take care of, and keep at ſome diſtance from it. The ſecond hour, move the fire nearer the pot, and when the fumes ceaſe, cloſe the hole with ſome clay: At the third hour put the coals cloſe to the pot, and give it a thorough heat: then let it cool of itſelf, and at the opening of the pot you will find a white, ſometimes a greeniſh white ſtone, which put up in a dry warm place, free from the air, to prevent its melting: Of this you are to take five ounces, and of borax three ounces; grind it well together, and let it melt in a large crucible till it is fluid; pour this into a refining cup, and you will have a fine tranſparent matter: what is not uſed, you may preſerve from the air to keep it from diſſolving.

f a thin blade of a knife, you may lift it up from the plate: f you find the matter too thin, add more iſing-glaſs to it; ut if too thick, add a little more water.

Of the Colours fit to be mix'd with the Iſing-glaſs, for Caſting of Pictures.

1. FOR red, mix with it ſome of the liquid in which you have boil'd ſcarlet rags.

2. For blue, take litmus diſſolv'd in fair water.

3. For green, take diſtill'd verdegreaſe, grind it as fine as poſſible, and mix it with the above materials.

4. For yellow, ſteep ſaffron in fair water.

5. A gold colour is made with the above red and ſaffron yellow.

6. Gold, ſilver, or copper, well ground, as is uſed for painting, are to be mix'd with the materials, and pour'd quickly over the plate. If you firſt rub printers black in the graving, the gold and ſilver will look the better.

To Caſt Plaiſter of Paris on Copper-Plates.

FIRST rub the colour, either red, brown or black, into the graving, and wipe the plate clean; then mix as much plaiſter as you think you ſhall have occaſion for, with freſh water to the conſiſtance of a thin paſte, and having put a border round the plate, of four ſquare pieces of reglets, pour the plaiſter upon it, and move it ſo as that it may run even all over the plate: let it ſtand for an hour, or longer, according to the dimenſions of the plate, and when you find it dry, and turn'd hard, take off the reglets, and then the plaiſter, and you will have a fine impreſſion of the copper graving. You muſt obſerve, not to mix more at a time than you have occaſion for, tor elſe it will grow hard before you can uſe it.

A Mixture which may be uſed for making Impreſſions of any kind, and which will grow as hard as Stone.

TAKE clean and fine ſifted aſhes, and find plaiſter of paris, of each an equal quantity, and temper the mixture with gum-water, or with ſize of parchment; knead it well together, and preſs it down into your mould; but do not prepare more than what you uſe preſently, elſe it will harden under your hands. You may give it what colour you pleaſe; in mixing it for black, take lamp-black; for red, vermillion; for white, flake-white; for green, verdegreaſe; for yellow, *Dutch* pink, *&c.*

You may inſtead of gum or ſize, uſe the whites of eggs, which is more binding.

To Impreſs Figures in Imitation of Porcelain.

CALCINED and fine pulveriz'd egg-ſhells, work'd with gum-arabick and the white of eggs into a dough, then preſs'd into a mould, and dry'd in the ſun, will come out ſharp, and look fine.

PART IV.

A Collection of very valuable Secrets, for the Uſe of SMITHS, CUTLERS, PEWTERERS, BRASIERS, BOOK-BINDERS, JOINERS, TURNERS, JAPANNERS, &c.

Choiſe Experiments on IRON and STEEL.

To make Steel of Iron.

TAKE ſmall iron bars of the fineſt ſort, powdered willow or beech-coals, the ſhavings of horn, and the ſoot of a baker's chimney; ſtratify theſe in an earthen pan, made for that purpoſe, with a cover to it. Firſt make a layer of the mixture, about an inch thick; then a layer of iron bars, then again the mixture, and ſo proceed, till the pan is full; note the top muſt be of the mixture: then put the cover upon it, lute it, and put it in a wind-furnace for 24 hours, and give it a reverberatory fire.

To

To harden Sword-Blades.

SWORD blades are to be made tough, ſo as that they may not ſnap or break in puſhing againſt any thing capable of reſiſtance; they muſt alſo be of a keen edge; for which purpoſe they muſt all along the middle be hardened with oil and butter, to make them tough, and the edges with ſuch things as ſhall be perſcrib'd hereafter, for hardening edged inſtruments: This work requires not a little care in the practice thereof.

How to imitate the Damaſcan Blades.

THIS may be done to ſuch perfection that one cannot diſtinguiſh them from the real damaſcan blades. Firſt poliſh you blade in the beſt manner, and finiſh the ſame by rubbing it with flower of chalk; then take chalk mix'd with water, and rub it with your fingers well together on your hand; with this touch the poliſh'd blade, and make ſpots at pleaſure, and ſet them to dry before the ſun, or a fire; then take water in which tartar has been diſſolved, and wipe your blade all over therewith, and thoſe places that are left clear from chalk will change to a black colour; a little after waſh all off with clear water, and the places where the chalk has been, will be bright; your watering will be the more perfect as you imitate it in laying on your chalk.

How the Damaſcan Blades are hardened.

THE *Turks* take freſh goat's blood, and after they have made their blades red hot, they quench them therein; this they repeat nine times running, which makes their blades ſo hard as to cut iron.

To perfume a Sword Blade, ſo as to retain always an odoriferous Scent.

TAKE eight grains of ambergreaſe, ſix grains of the beſt biſem, four grains of right cibeth: grind them together with a little ſugar-candy, in a glaſs or agat mortar; after this add to the mixture four ſcruples of the beſt benjamin oil, and mix it well together; then hold the ſword blade over a gentle, clear coal fire, and when the blade is well heated, dip a little ſpunge in the forementioned mixture, and wipe your blade all over; tho' you do this only once, yet the odoriferous ſcent will remain, although the blade was to be poliſhed again.

To harden Steel and Iron, which will reſiſt and cut common Iron.

TAKE ſhoe-leather, and burn it to powder, the older the leather is, the better it is for uſe; ſalt, which is diſſolv'd and glaſs-gall powdered, of each an equal quantity; Then take what you deſire to harden and wet it therewith, or lay it in urine, and taking it out, ſtrew it over with this powder, or elſe ſtratify it therewith in an earthen pan; give it for five hours a ſlow fire to cement, and make it afterwards red hot for an hour together.

To Temper Steel ſo as to cut Iron like Lead.

TAKE the ſteel and purge it well, then diſtil from earthworms, in a limbeck a water, which mix with an equal quantity of the juice of rediſhes; in this liquid quench your ſteel blades of knives, daggers, ſwords, *&c.* and they will be of an excellent temper.

Several other Temperings of Steel and Iron.

1. IRON quench'd in diſtill'd vinegar, or in diſtill'd urine, becomes of a good temper.

2. Vinegar, in which ſal-armoniac has been diſſolv'd, gives a good temper.

3. So doth the water in which urine, ſalt, and ſalt-petre have been diſſolv'd.

4. Caput mortuum of aqua fortis, boil'd for an hour in water, and filter'd through a clean cloth, makes a tough hardneſs.

5. Mix together an equal quantity of ſalt-petre and ſal-armoniac, and put the mixture into a vial with a long neck, then ſet it in a damp place, or in horſe-dung, where it will turn to an oily water; this liquor will make iron works of an incomparable temper and hardneſs, if quench'd therein red hot.

6. A lee made of quick-lime and ſalt of ſoda, or of potaſhes, filter'd through a linnen cloth, gives a very good hardneſs to iron, if quenched therein.

7. The dung of an animal which feeds only on graſs, tempered with water and calcined ſoap, and mix'd to a thin paſte, gives ſuch a good temper to iron, as to make it cut untempered iron.

8. Or take ſpaniſh radiſhes, grate them on a grater, and expreſs their juice; this gives a good temper to iron or ſteel quenched therein.

9. Take the juice of nettles, freſh urine of a boy, ox-gall, ſalt, and ſtrong vinegar, equal quantities of each; this mixture give an incomparable temper.

10. Red hot iron or ſteel, wip'd over with gooſe greaſe, and then quench'd in ſour beer, takes alſo a good temper.

A particular Secret to harden Armour.

MAKE the following mixture, taking of each an equal quantity; as common ſalt, orpiment, burn'd goat's horn, and ſal-armoniac; powder and mix them together; then anoint the armour with black ſoap all over, ſtrew this powder upon them, and wind a wet rag about them, and lay them in a fierce charcoal fire, till they are red hot; then quench them in urine. If you repeat it, it will be the better.

To Temper Steel or Iron, ſo as to make excellent Knives thereof.

TAKE clean ſteel, quench it in five or ſix times diſtill'd rain or worm-water, and the juice of ſpaniſh radiſhes; the knives made of ſuch ſteel will cut iron.

Take black or ſpaniſh radiſhes, grate them on a grater, put ſalt and oil upon them, and let them ſtand two days. Then preſs the liquor out, and quench the ſteel or iron ſeveral times, and it will be very hard.

To bring Gravers and other Tools to their proper Temper.

TAKE a little fire pan with live coals, and put a couple of old files, or any other ſmall bars of iron over them; then lay your gravers upon them over a gentle clear charcoal fire, and when you ſee them change to a yellowiſh colour, it is a ſign that they are ſofter; after this colour they change to a reddiſh, which ſhews them ſtill ſofter; and if you let them turn to a blue, then they are quite ſoft and unfit for uſe: after this manner you may ſoften any ſteel that's too hard.

General Rules to be obſerved in Tempering of Iron or Steel.

WE know by experience, that the tempering of iron is perform'd and executed ſeveral ways; for every mechanical branch requires a particular method of hardening; the tools that are uſed for wood, require a different temper or hardneſs from thoſe uſed in cutting of ſtone or iron, and therefore thus are prepared, according to the ſeveral methods treated of before: an artiſt ought therefore to acquaint himſelf with the nature and quality of the different ingredients and liquors that are here preſcrib'd, and improve upon ſuch as ſeem moſt promiſing. He is to obſerve the degrees of heat, which he is to give, and the length of time he is to keep the metal in the liquor for quenching; for in caſe the iron be made ſo exceſſively hot, that it is not capable of receiving a greater degree of heat, it cannot well be quenched, and it will become canker'd; but if it appears of a ſaffron or reddiſh colour, it is call'd gold, and is fit to be quench'd for hardening: however in this as well as moſt other things, practice is the beſt inſtructor.

A curious Method of hammering Iron without Fire, and making it red hot.

TAKE a round iron, about an inch thick; at one end thereof fix a round iron knob; then begin gently to hammer it under the knob; turning it quickly round, and by following your ſtrokes harder and harder, the iron will heat of itſelf, and begin to be red hot; the reaſon is, becauſe the knob remains untouch'd, and the heat on each of the motions cannot diſſipate.

To Soften Iron or Steel that's brittle.

1. ANoint it with tallow all over, neal it in a gentle charcoal fire, and let it cool of itſelf.

2. To neal it thus with human excrement, ſoftens it; but you muſt keep it in the fire for two hours.

3. Or, take a little clay, lime, and cow's dung; cover your iron therewith, and neal it in a charcoal fire: Then let it cool of itſelf.

4. Or, make iron or ſteel red hot, and ſtrew upon it good hellebore, and it will become ſo ſoft that you may bend it which way you pleaſe; This is very uſeful for thoſe who cut in iron or ſteel.

5. Take lead, put it into a crucible, or iron ladle, and melt and pour it into oil; this repeat ſeven times running. If you afterwards quench iron or ſteel in this oil, it will be very ſoft; and after you have ſhap'd or work'd it in what manner you deſign'd it, you may harden it again by quenching it in the juice of onions.

6. Take lime, brick-duſt, and *Venice* Soap; with this anoint your ſteel and neal it; then let it cool of itſelf.

7. Take the root of blue lillies, cut it fine, infuſe it in wine, and quench the ſteel in it.

8. Wind about the ſteel ſome thin ſlices of bacon, and over that put clay, let it neal for an hour, and the ſteel will be very ſoft.

9. Take quick-lime and pulverized ſoap, of one as much as the other; mix it together, and temper it with ox's blood; with this anoint the ſteel; then lay a covering of clay over it, and let it neal and cool of itſelf.

10. Take the juice or water of common beans, quench your iron or ſteel in it, and it will be as ſoft as lead.

A particular Powder and Oil, to take off the Ruſt and Spots of Iron, and to preſerve it from Ruſt for a long Time; very uſeful in Armories.

TAKE two pounds of crucible powder, of ſuch as is commonly uſed for refining of ſilver, and ſift it through a fine hair ſieve: then take four pounds of emery, and one pound of ſilver oar; pound them all very fine, and ſift them; put at laſt fine beaten ſcales of iron to them, and the powder is fit for uſe.

To prepare the Oil for it.

TAKE three pound of *Lucca* oil, and put it into a copper baſon or pot; then take three pound of lead, melted, and pour it into the oil, take it out, and melt it again, and repeat melting and pouring ſeveral times; the oftener, the better the oil will be. After you have done this, and the heat of the lead has extracted both the greaſineſs and ſalt of the oil, take the lead out, and put the oil into a glaſs; fling three pound of filings of lead into it, ſhake it will together; pour it afterwards on a colour ſtone, grind it together as painters do their colours, put it again into the glaſs, to preſerve it for uſe: the lead will ſink to the bottom, and the oil ſwim a top, which you may uſe in the following manner.

Take ſome of it in a bit of cloth, on which there is ſome of the before-mentioned powder, and rub the ruſt of ſpots upon armour or any other iron work therewith, and it will take it clean off; and if afterwards you anoint the armour or iron work with a clear oil, it will keep it from ruſt for a long time.

N B. The emery which is uſed among the other ingredients of the powder, muſt be firſt calcined, which you are to do thus: lay it on a coal fire, and when you ſee it of a red colour, take it out and beat it in a mortar, and it is fit to be mix'd with a ruſt powder.

Another.

FRY a middling eel in an iron pan, and when brown and thoroughly fry'd, expreſs its oil, and put it into a phial, to ſettle and become clear, in the ſun. Iron work, anointed with this oil, will never ruſt, although it lie in a damp place.

To etch upon either SWORD or KNIFE-BLADES.

To prepare the Etch-Water.

TAKE mercury and aqua fortis, put them together into a glaſs, till the mercury, is conſumed, and it is fit for uſe.

To make the Ground.

TAKE three ounces of red lead, one ounce of white lead, half an ounce of chalk, all finely pounded; grind theſe together with varniſh, and anoint your iron therewith; let it dry in the ſun, or before a ſlow fire, and with a pointed ſteel or needle draw or write on it what you pleaſe, and then etch it with the above prepared water.

Another Water to etch with.

TAKE two ounces of verdegreaſe, one ounce of burnt allum, and one ounce of diſſolv'd ſalt; boil this mixture in one quart of vinegar, till it is half boild away, and when you are ready to etch, warm, and pour it with a ſpoon or glaſs cup over your work; hold it over the fire to keep it warm, and repeat this till you find it etch'd deep enough.

To etch 100 *or more Knife-Blades at once.*

GRIND red lead with linſeed oil or varniſh; with this wipe your blades, all over, and let them dry well and darden; then write or draw with a pointed bodkin whatever you will: then put them at ſome diſtance from each other, into a glaſs or well glaz'd pot or pan; diſſolve ſome vitriol in hot water, pour it over the blades, and lute the glaſs or pot; ſet it over a gentle coal-fire, let it boil for ſome time, and then let it cool; then take your blades out, ſcrape the red lead off, and you will find the etching to your ſatisfaction.

To make blue Letters on Sword-Blades.

TAKE the blade, hold it over a charcoal fire till it is blue, then with oil colours write what letters you will upon the blade, and let them dry; when dry, take good ſtrong vinegar, make it warm, and pour it all over the blade, this will take off the blue colour; then wet your oil colour with freſh water, and it will come off eaſily, and the letters drawn therewith, remain blue.

To harden Fiſhing Hooks

AFTER you have (of good wire) made your ſmall fiſhing hooks, you muſt not put them into the fire to harden, but lay them upon a red hot iron plate, and when they are red, fling them into water; take them out again, and when dry, put them again on the hot iron plate, and when they appear of an aſh-colour, fling them again into cold water; this will make them tough, otherwiſe they will be brittle.

To gild upon Iron or Steel,

TAKE common ſalt, ſaltpetre and allum, an equal quantity of each, diſſolve them in as little warm water as poſſible; then filter them through a whited brown paper, add leaf gold, or rather thin beaten gold to it, and ſet it on hot ſand, to make it almoſt boiling hot; keep it in that heat for 24 hours, and if the water evaporate, you may ſupply it with more; but at laſt let it all evaporate, and it will turn to a yellow ſalt; this pulveriſe; put it into a glaſs, and cover it with ſtrong brandy, or ſpirit of wine, two inches high above the powder: then ſtop your glaſs cloſe, put it into a gentle warmth, and the brandy or ſpirit will extract all the gold, and be of a beautiful colour. With this water you may, with a new pen or pencil, wright or draw what you pleaſe, upon a ſword-blade, knife, or any other thing made of iron or ſteel, and it will be gilded to a high colour.

A Ground for Gilding Steel or Iron.

TAKE five ounces of vitriol, two ounces of galiz-ſtone, two ounces of ſal-armoniac, one ounce of feather-white, and a handful of common ſalt: beat all this together till it is fine, and mix it well; put it into a glaz'd pipkin, add to it a quart of water, and give it a quick boiling; then take a knife, or any other iron that is clean, and ſtir it about; if it is of a copper colour it is right; but of a red colour it is better.

If you have a mind to gild with this ground, put your ſteel on a ſlow fire, and make it ſo hot that you can't bear it in your hand; then take your ground, and dipping ſome cotton into it, wipe the ſteel with it; take afterwards quickſilver, and wipe your ground over, then take the prepared gold, and lay it on ſuch places as you would have gilded; after you have done this, lay it on a charcoal fire, till it turns yellow; then wipe it over with tallow, and take cotton to wipe your blade, holding it all the while over the fire, till it inclines to a black; rub it with a woolen cloth, till that colour vaniſhes, and rub it again with chalk, till you bring it to a fine gloſs. If you would have the ground brown or blue, hold it over the fire, till in turn either to the one or the other colour; then wipe it over with wax, and poliſh it with chalk.

Of LEAD and PEWTER.

To make Pewter hard.

TAKE one pound, or what quantity you pleaſe of pewter, and let it melt in an iron pan; add to it ſome ſallet oil, let it evaporate well, and ſtir it continually, keeping the flame from it; add to this ſome fine wheat flour, and ſtir it well about; then take all the burnt matter off the top, and to each pound of tin add three or four ounces of plate braſs, cut in ſmall pieces, mix'd with oil, and a few ounces of pulveriz'd biſmuth, or regulus of antimony; ſtir it, all the while, and when all is melted and incorporated, you will not only have a pewter that's harder and whiter, but alſo different in its ſound from common pewter. *Or,*

MELT tin in an iron pan, ſtrew colophoni or roſin, with fine wheat flour mix'd together, into it, and ſtir it gently about: this takes off the blackneſs, and makes it of a fine white colour.

If you would have it hard, add to each pound of tin one or two ounces of pulveriz'd regulus of antimony and veneris; this makes it white, hard, and gives it a clear ſound.

Another Method to make Pewter as white as Silver.

TAKE clean copper one pound, and let it flux; add to it of the beſt *Engliſh* pewter one pound, and continue the flux; to this add two pound of regulus of antimony and martis, and let it ſtill flux for half an hour; then caſt it into an ingot. Beat this in a mortar to a fine powder, and fling thereof as much into the melted tin as you think requiſite: You will find it (after you caſt it) of a fine ſilver colour, it will be hard and give a fine ſound: To make it flux the better, you may add a little biſmuth. *Or,* MELT one pound of copper, add to it one pound of tin, half a pound of zink, one pound of *Reg. Antim. & Martis*; let them flux for half an hour, and caſt them into an ingot.

N. B. The *German* author ſays, there are many more ſecrets relating to whitening and hardening of pewter, but thinks it not proper to divulge them; and adds, that he has found by experience, that the *Reg. Antim. & Veneris* is better for that uſe, than the *Reg. Antim. & Martis*; becauſe the laſt will turn the pewter in time to a dirty blue; whereas the former will make it continue white, hard, and of a good ſound.

To make Tin or Lead Aſhes.

TAKE which ſort of theſe metals you will, let it melt, and fling well dry'd and beaten ſalt into it; ſtir it well together with an iron ladle or ſpatula, till it ſeparates, and forms itſelf into a powder. *Or*,

AFTER the tin or lead is melted, pour it into fine dry ſalt, ſtir it together till it is fit for ſifting: Then put this powder into a pan of clean water, and ſtir it; pour off the firſt water, and put freſh to it; repeat this ſo often till the water comes off clear, and without the taſte of any ſalt. The remaining powder put into a melting pot, ſet it in a reverberatory furnace, ſtir it well together, and you will have fine white tin-aſhes.

A Gold Colour upon Lead or Tin.

TAKE ſaffron, as much as you will, and put it into ſtrong gum water; add to it a third part of vinegar, and let it ſoak over night; then mix it with a little clarified honey, ſtir it well together, and let it boil till it comes to the conſiſtence of honey; ſtrain it afterwards through a cloth, and it is fit for uſe. *Or*,

TAKE linſeed oil, skimm'd over the fire, and add amber and hepatic aloes, of each an equal quantity; ſet it over a fire, and ſtir it till it is thick; then cover it all over with earth for three days. If you anoint your tin or pewter therewith, it will have a fine gold colour.

A Water to Tin all Sorts of Metals, but eſpecially Iron.

TAKE one ounce of fine pounded ſal-armoniac, and put it into very ſour vinegar, and when you would tin iron, waſh it firſt with this vinegar, and ſtrew beaten roſin over it; dip it into the melted tin, and it will come out with a fine and bright luſtre.

To make Tin which ſhall have the Weight, Hardneſs, Sound, and Colour of Silver.

TAKE fine long cryſtal antimony, beat it fine, and waſh it in water till it becomes ſleek, and let it dry again. Then take well dry'd ſalt-petre and tartar, of each an equal quantity, beat them fine, and put them together into an earthen pan, on which lay ſome live charcoal, and the ſalt-petre and tartar will ſoon begin to fulminate: Then cover the pan with a lid, let the matter burn out and cool, and you will find a yellow ſalt: This ſalt beat to powder before it is quite cold, and put thereof into a crucible one pound, and of the waſh'd antimony two pounds. Mix them well together, and let it flux in a wind furnice for three quarters of hour; Then fling a few lighted ſmallcoal into them, let them conſume, and ſtir them well together with a ſtick. Preſently after take the crucible out of the fire, beat it a little down to the bottom, and let it cool of itſelf; then break the crucible, and you will find a ſilver colour'd regulus, of three quarters of a pound weight.

Then take two pound of old copper cut it fine, neal it, and quench it, ten times running, in very ſtrong lee made of the above tartar and rain water. Take it, while wet, and put it into a crucible, with one pound fine beaten arſenick, *ſtratum ſuper ſtratum.* When all is in the crucible, pour as much linſeed-oil on it as will cover the matter; then cover and lute your crucible, put it into a new pan, fill it all round with ſand, and ſet it three hours in a circle-fire: After it is cold, open it, and you will find the copper ſpungy and of ſeveral colours. Of this take two pounds, and plate-braſs two pounds, melt theſe together; add by degrees the copper, and give it a quick fuſion in a wind furnace: Then add two pounds of *Engliſh* pewter, half a pound of biſmuth, and two pounds of the above regulus; let it flux well, then pour it out, and you will have a fine ſilver mixture. Beat this into a fine powder, mix it with linſeed oil to a paſte, and with a ſpatula add it to the melted pewter: ſtir it well together, and you will have a fine tin, which will reſemble ſilver in every thing, except the teſt.

To make Tin flow eaſy.

TAKE roſin and ſaltpetre, of each an equal quantity, beat them to powder, and ſtrew them upon the tin when in fuſion.

A particular Method to make Tin reſemble Silver.

MELT four ounces of fine plate-braſs, add to it four ounces of fine clean tin, and when it is in fuſion, add four ounces of biſmuth, and four ounces of *Regul. Antim.* let this flux together, and pour it out into an ingot; then beat it to powder, grind it with roſin and a little ſal-armoniac, and with turpentine form it into balls; let them dry in the air, and when you would uſe them, beat them fine, ſtrew the powder thereof upon the melted tin, ſtir it well together, and continue puting the powder'd balls upon the tin, till you preceive it white and hard enough: of this tin you may draw wire for hilts of ſwords, or make buttons, it will always retain its ſilver colour.

Solder to ſolder Tin with.

TAKE tin and lead, of each one ounce; biſmuth two ounces; melt theſe, and pour them over a plate to caſt them thin: with this you may ſolder over a candle or a ſmall charcoal fire.

Another Solder for Pewter.

TAKE roſin and oil, let them melt in a ſpoon, and fling into them a little devil's dung, then pour them out; and having new filed the two broken pieces, anoint them with the roſin, duſt ſome fine filed tin over it, and hold it over a coal-fire, and when it flows, take it off and let it cool.

To make Tin Coat-Buttons, in Imitation of Work'd Buttons of Gold and Silk.

TAKE lampblack, grind it with oil of ſpike, and mark the ground-work with a pencil; when dry, draw it all over with the varniſh before deſcrib'd: the beſt way to imitate worked bottons is, to do them in a fine mould, either ſtamp'd or caſt, the ground firſt fill'd up with black, blue, red, or any other colour; then the raiſed part is to be wip'd very clean, and when dry, to be drawn over with the varniſh, which will make it look much finer than what can be done upon a plain button.

For a brown colour take umber.

For green take diſtill'd verdigreaſe, mixed with other colours, to make it either deeper or lighter.

For gray, take white lead and lampblack.

All your colours muſt be ground with oil of ſpike.

In this manner you may embelliſh ſome pewter with a coat of arms, a cypher, or ornaments; I mean ſuch pewter things as are not to be ſcower'd.

The Art of making Tin Plates, or Latten.

THERE are only certain ſorts of iron, which can be reduced in leaves for that purpoſe, the beſt is that, which when heated is eaſieſt extendible, and can be forged with a hammer, when cold: the more ſoft and exceeding flexible, as well as the more brittle, are to be rejected. Theſe leaves are drawn from bars of iron about an inch ſquare, which being made a little flat they cut into thin pieces, which they fold together into parcels, each parcel containing about 40 leaves, which they batter all at once with a hammer of 6 or 700 *lb.* weight. After this the principal of the whole art is to prepare theſe leaves, for the leaſt duſt or ruſt upon their ſurface, will hinder the tin from uniting with them: this indeed might be taken off by filing, but that being both too tedious and expenſive, there is a way to do it by ſteeping them in acid water for a certain time, ſcowering them with ſand when taken out; by which method a woman can clean more plates in an hour, than an expeditious worman can file in ſeveral days. This water, which is kept a mighty ſecret is nothing elſe but common water, made eager with rye, which requires very little pains, for after they have ground the grain groſly, and pounded it, they leave it to foment in common water for a certain time, and with a little patience they are ſure to have an eager menſtruum: with this they fill troughs or tuns, into which they put piles of iron plates, and to make it grow eager the better, and have more activity, they keep theſe veſſels in vaults or ſtoves, which have little air, and in which they keep lighted charcoal: the workmen go into theſe vaults once or twice a day to turn the plates, to take out ſuch as are ſufficiently cleanſed, and put others in the room: and as the liquor is more acid, or the heat of the vault or ſtove more intenſe, the plates are ſooner cleanſed, but it requires at leaſt two days, and ſometimes a longer time. This is the method the *Germans* uſe for preparing the iron plates for tinning. In *France* they go another way to work; they dip the iron plates in acid menſtruums, as in water wherein allum, common ſalt, or ſal-armoniac are ſeparately diſſolved, and inſtantly expoſe them to the air, in order to ruſt. After two days, during which every plate had been dipt into the menſtruum twice or thrice, they are ſcour'd. Theſe menſtruums, tho' weak in themſelves produce the effect as well as the ſtronger, which are much dearer; among the latter vinegar is the moſt effectual, eſpecially if you diſſolve a little ſal-armoniac therein, about a pound or two in a puncheon, by this means the iron ruſts ſooner than with any other ſalt, but it muſt be uſed very moderately, and the leaves be left to ſteep in clean water to diſſolve any particles of it, that may ſtick to it's ſurface, which may otherwiſe make it ruſt after it has been tinn'd.

In the preparation of the plates it muſt be obſerv'd, 1. That in battering them, each parcel receive the immediate action of the hammer in it's turn, otherwiſe they will not extend equally. 2. To ſteep them in clay or fullers earth, tempered with water before you heat them, to prevent their ſoldering with one another.

Whether you make uſe of the *German* or *French* way in preparing your plates, it is abſolutely neceſſary, after the plates are ſufficiently ſcal'd, to ſcower them with ſand, and when there remain no more black ſpots on their ſurface, to throw them into fair water to prevent their ruſting again, where let them remain 'till you are ready to tin them; the manner of doing it is this: Flux the tin in a large iron crucible, of the figure of a broken pyramid with four ſides, of which two oppoſite ones are leſs than the two others: this crucible you heat from below, the upper rim you muſt lute quite round in the furnace; The crucible muſt be deeper than the plates are long, which you dip in downright, ſo as for the tin to ſwim over them. The tin being melted in the crucible, you cover it with a layer of a ſort of ſuit, an inch or two thick, thro' which the plate muſt paſs before it comes into the tin, the uſe of this is to keep the tin from burning: The common unprepared ſuit will render the ſucceſs of the work uncertain; wherefore you prepare it by firſt frying and then burning it, which not only gives it a blackiſh colour, but puts it into a condition to give the iron a diſpoſition to be tinn'd, which it does ſurpriſingly.

The tin itſelf muſt have a certain degree of heat; for if it is not hot enough, it will not ſtick to the iron; if too hot, the coat will be too thin, of ſeveral colours, and a dirty yellow caſt. To prevent this, you muſt make an eſſay with ſmall pieces of the ſcal'd plates, and ſee when the tin is in proper order. However, you dip the plates into tin that is more or leſs hot, according to the thickneſs you'd have the coat thereof: Some plates you only one give layer, and theſe you plunge into tin, that has a leſſer degree of heat than that into which you plunge thoſe which you would have take two layers: when you give theſe plates the ſecond layer, you put them into tin that has not ſo great a degree of heat, as that into which they were put the firſt time. Obſerve, that the tin which is to give the ſecond coat muſt be freſh covered with ſuit, but only with the common ſort without preparation: for, melted tin is ſufficiently diſpoſed to attach the new tin to be joined.

To Gild upon Tin, Pewter, or Lead.

TAKE varniſh of linſeed oil, red lead, white lead, and turpentine; put them together into a clean pipkin, and let them boil; then grind them upon a ſtone, and when you would gild pewter, take a pencil, draw the liquid thin upon what you would gild, and lay your leaf gold upon it; or inſtead of that, *Augsburg* metal, and preſs it with cotton to make it lie cloſe.

Another Method to gild Pewter or Lead.

TAKE the white of an egg, and beat it clear; with this wipe your tin or pewter, which muſt be firſt warm'd before a gentle fire, in ſuch places as you deſign to gild; lay on your leaf gold quick, and preſs it down with cotton.

The juice of nettles is alſo fit for that uſe, and rather better than the egg-clear.

Another Method to gild Pewter.

TAKE leaves of ſtaniol, and grind them with common gold ſize; with this wipe your pewter or lead over; lay on your leaf gold, and preſs it with cotton: it is a fine gilding, and has a beautiful luſtre.

A Method to gild with Pewter, or Lead Leaves.

THIS may be done ſeveral ways, but the beſt is, to take white lead, ground with nut-oil, with this lay your ground on what you deſign to gild, let it be wood or any thing elſe, then lay on your gilded tin leaves, preſs them down with cotton, or a fine rag, and let it dry; when dry, poliſh it with a horſe's tooth or poliſher, and it will look as if it had been gilded in fire.

To gild Lead.

TAKE two pound of yellow oaker, half a pound of red lead, and one ounce of varniſh; with which grind your oaker, but the red lead grind with oil, and temper them both together; lay your ground with this upon the lead, and when it is almoſt dry lay on your gold; let it be thorough dry, then poliſh it.

Some Experiments relating to COPPER and BRASS.

To make Braſs.

THIS is done by mixing and melting copper and calamine together: Calamine is dug in mines about *Mendip*, *&c.* in the *Weſt* of *England*; it is burnt and calcined in a kiln made read hot; then it is ground to a powder, and ſifted to the fineneſs of flower, and mix'd with ground charcoal, becauſe the calamine is apt to be clammy, to clod, and not ſo apt to incorporate; then they put 7 pounds of calamine into a melting pot that holds about a gallon, and about 5 pounds of copper, uppermoſt; this is let down with tongs into a wind furnace, 8 foot deep, wherein it remains 11 hours, one furnace holds 8 pots, after meltiag it, it is caſt into Lumps or Plates.

To melt Copper and Braſs, and give it a quick Fuſion.

TAKE ſultpetre, tartar and ſalt, beat them together very fine; when you ſee that your metal begins to ſink with the heat, fling a little of this powder into it, and when melted, fling again a little into it, and when you obſerve it in fuſion like water, fling a little again a third time: to 25 pound of metal fling about a walnutful of powder, and your copper or braſs will caſt eaſily, and be of a malleable temper.

To make Braſs malleable that is brittle, and apt to crack in the Working.

TAKE tartar, ſaltpetre, and ſulphur, pulverize them together, and after you have made your braſs red hot, ſtrew it all over, and let it cool of itſelf.

A Solder for Braſs.

TAKE one grain and a quarter of ſilver, three ounces of braſs, one ounce of zink, and melt them together; when melted, fling a good quantity of *Venice* borax upon them.

To Sink Copper which is in Aqua-Fortis.

TAKE fine mill'd Lead, cut it in little bits, and put it in aqua-fortis, which holds copper and it will precipitate or ſink it all to the Bottom.

To make Copper as white as Silver.

PUT your copper into a ſtrong melting pot, in the midſt of a quantity of glaſs, and ſet it in a glaſs furnace to melt; let the copper be cover'd all over with glaſs, and the glaſs will contract the greeneſs of the copper, and make it look white. If you repeat this ſeveral times, your copper will be the whiter. *Or,*

TAKE old copper, that has been much uſed, or been long in the open air and weather; melt it in a ſtrong crucible before a ſmith's forge, or in a wind furnace, but take care of the ſmoak; let it melt a quarter of an hour, or longer, and clear it from the ſcales that ſwim a-top: then pour it through a whisk or birch-broom into a ſharp lee, made either of quick-lime and wine-branch-aſhes, or of ſalt of tartar, or *Caput Mortuum* of diſtill'd ſpirit of nitre, or ſuch like, and the copper will corn fine and nice: then take it out of the lee, and let it melt again as before; repeat this four times running, in order to purify the copper, and when the copper is well purified, melt it over again; when it is in fuſion, fling two ounces of cryſtalline arſenic in, by little and little; but avoid the ſmoak, and tie a hankerchief, moiſtened with milk, about your mouth and noſe: after it has evaporated, or rather before it is done, fling into it two ounces of ſilver; and when that is melted, granulate it again through a whisk, and melt it again for uſe. It will be fit to make any thing in imitation of ſilver. *Or,* TAKE white arſenic half a pound, ſaltpetre eight ounces, tartar eight ounces, borax four ounces, glaſs-gall four ounces; pulverize each very fine, then mix and put them together in a crucible, and let them flux in a wind furnice for an hour or more; then pour them out, and you will have a whitiſh yellow ſubſtance.

Then take one part of old copper, and one part of old hammer'd braſs, both cut into ſmall pieces; neal theſe well, and quench them in a lee made of a quart of urine, an handful of ſalt, four ounces of white powdered tartar, and two ounces of allum: boil them up together, which repeat for 10 or 12 times.

When thus you have cleanſed the copper and braſs, put them together into a crucible, and give them a ſtrong fire in a wind-furnace, or before a ſmith's forge; let them flux well, and then fling of the above compoſition, (which muſt be pulverized) one ſpatula full after another into the crucible, ſtirring it ſometimes about with a ſtick; to one ounce of copper take an ounce and half of powder; when all is thrown in and incorporated, then fling a few pieces of broken crown glaſs into it, and let it melt; then draw it out again with a pair of tongs, and fling ſal-armoniac into it, of the bigneſs of a walnut, and when it is thoroughly fuſed, pour it out into a caſting pot, and your copper will be of a fine white.

If you take of this copper 24 ounces, and melt one ounce of ſilver amongſt it, letting it flux well with ſal-armoniac, you will have a fine maſs, which may be worked into what shape, or into any utenſil you pleaſe, and it will hardly be diſtinguiſhed from ſilver plate.

When the ſilverſmith works this compoſition, he muſt obſerve always in the melting, to fling ſome ſal-armoniac into it to make it malleable: and in hammering he muſt often neal it and let it cool of itſelf; then hammer it gently, till it is as thin as he would have it; for if it is beat quick in the begining, it will be apt to crack.

The more this metal is neal'd and gently hammer'd, the better it will be. When the work is done, neal it; then rubbing it with charcoal, and boiling it afterwards three times in a ſtrong lee of tartar, your work will be like ſilver.

Choice Secrets for BOOK-BINDERS.

To prepare a Lack Varniſh for Book-binders, for French Bindings.

FIRST, when the book is covered, either with calf or ſheep-skin, or with parchment, it is ſtruck over with a varniſh, and ſpotted with ſuch colours as are taught under the article of imitating tortoiſes on ivory or horn: ſome will ſpot the leather before they lay on the varniſh, and after they have ſprinkled their colour (which they commonly make of umber) they lay the varniſh over, and poliſh it with a ſteel poliſher, after which they give it one layer of varniſh more, which is the finiſhing ſtroke.

French *Leather for binding of Books.*

MAKE choice of ſuch leather as is wrought ſmooth and fine, and ſtrain it on a frame; then having your colours ready at hand, take firſt of one ſort in a pencil made of hog's briſtles, and with your finger ſprinkle the colour thereof upon the leather; and when you have done with one, you may take another colour, and proceed with as many colours as you think proper; if you would imitate a tyger's skin, dot your colours upon the leather with a ſtick that is rough at the end, or a pencil; and after it is well dryed, lay it over with a *Spaniſh* varniſh, which make in the following manner:

Take a pint of high rectified ſpirit of wine, of clear gum ſandarac four ounces, clear oil of ſpike one ounce; pound the ſandarac, and put it into the ſpirit of wine, and then into the oil of ſpike; let it ſtand till it is diſſolved and ſettled.

To make white Tables for Memorandum Books, to write upon with a Silver Bodkin or Wire.

TAKE of the fineſt plaiſter of paris, temper it with harts-horn or any other glue; and having ſtrain'd your parchment tite and ſmooth in a frame, wipe it over with the ſaid mixture on both ſides, and when dry, ſcrape it to make it even, then cover it a ſecond time with the ſame glue, and when dry, ſcrape and ſmooth it as before; this done, take ceruſe, grind it fine with linſeed oil, that has been boyl'd, and with a ſoft hair pencil lay it ſmooth and even on your parchment or tables, and ſet it to dry in a ſhady place, for 5 or 6 days; when dry, wipe them over with a damp ſpunge or linnen rag to ſmooth them, ſetting them to dry thoroughly 'till fit for uſe; then with a ſharp edged knife cut the tables what ſize you pleaſe to have them, and bind them fit for the pocket with a little caſe for the ſilver bodkin or wire to write with.

To prepare Parchment that reſembles Jaſpis or Marble.

HAVE a trough, made in the manner directed under the article of making marbled paper; let it be fill'd with warm water of gum tragant, and having your colours ready prepared (as will be directed) ſtir the gum water with a ſtick and put it into a quick circular motion: in the interim dip your pencil with colour in the centre thereof, the colour will diſperſe and form itſelf in rounds, as it is carried by the motion of the water: then ſtir it round in another place, and with a different colour proceed as you did with the firſt, till your trough is covered with variety of colours. When all is ready, and the water ſmooth and without motion, then lay on your parchment (which before has been laid between damp paper or cloths) and proceed therewith as you do with marbled paper; hang it up to dry, then ſmooth and glaze it in the manner you do coloured parchment.

A Green tranſparent Parchment.

WASH the parchment in cold lee, till it comes clear from it, then ſqueeze out the liquor as much as poſſible, and if you would have it of a fine green colour, take diſtilled verdigreaſe, ground with vinegar, and add a little ſap-green to it, temper it neither too thick nor too thin; then ſoak your parchment in this colour thoroughly, a whole night; rinſe it afterwards in water; ſtrain it immediately on a frame, and ſet it to dry; then take clear varniſh, lay it on both ſides; ſet it in the ſun to dry; after this cut the parchment out of the frame into leaves, as large as you pleaſe, and lay them in a book under a preſs, to keep them fine and ſtraight; the effect of this parchment is, to make a ſmall letter, when put over it, appear as big again; and it is a great preſerver of the eyes, eſpecially to thoſe that read much by candle light.

The varniſh muſt be prepared of linſeed oil, and boiled with frankincenſe, maſtick and ſandarac.

If you would have the parchment of a clear, tranſparent and white colour, only waſh, ſtrain, and varniſh it, as above.

If you would colour it yellow, ſteep your parchment, after it has been waſhed, in a yellow liquid, made of ſaffron; for which purpoſe tie ſaffron in a thin linnen rag, hang it in a weak lee, and let it warm over a ſlow fire, and when you ſee the lee tinctured yellow, it is fit for uſe.

For tranſparent Red.

TAKE braſil, as much as you will, put it into a hot lee, which is clear, and not too ſtrong, and it will tincture the lee of a fine red; then pour in about half an egg-ſhell full of clear wine, draw the parchment through the colour, and when it is as deep as you would have it, ſtrain it, as before.

For a Blue.

TAKE *Lombard* indigo, grind it with vinegar on a ſtone, and mix ſal armoniac among it, to the quantity of a pea, with this wet your parchment, and proceed as has been directed for the green.

For a Violet or Purple Colour.

TEmper two thirds of the above red, and one third of the blue, and uſe it as before directed.

For a Black Colour.

TAKE *Roman* allum, beat it into powder and boil it in rain-water to a forth part; then add *Roman* vitriol or atrament, with ſome *Roman* galls, and boil them together; with this ſtrain your parchment twice or three times over and when dry, lay the *Spaniſh* varniſh over it.

N. B. With theſe tranſparent parchments you may make curious bindings; one ſort, uſed at *Rome*, is made thus: lay the board or paſte-board over with leaf gold, leaf ſilver, ſtaniol, metal leaves, *&c.* then binding the parchment over it, it will give it an uncommom luſtre and beauty.

To Gild the Edges of Books.

POUND bole armeniac and ſugar candy together, and mix it with a proper quantity of the white of an egg, well beaten; this done, take the book you intend to gild, which muſt be well bound, glewed, even cut, and well poliſh'd, ſcrew it faſt in the preſs, and as even as poſſible, then with a pencil give it a wipe with the white of an egg well beaten, and let it dry; then give it another wipe with the above compoſition, and, when dry, rub and poliſh it well; and when you will lay on the gold wet the edges with a little fair water, and immediately thereupon lay on the gold leaves, cut of the ſize they are to be, preſſing them down ſoftly with clean cotton wool, and when dry, burniſh it with a dog's tooth.

To make red Braſil Ink.

YOU muſt firſt obſerve, that when you boil braſil for ink, you ought to do it when the weather is fair, and the sky without clouds or winds, or elſe your ink will not be ſo good.

Take quick-lime, pour rain water on it, and let it ſtand over night. In the morning pour the clear from off the top, through a cloth; and to a quart of this water take one pound of braſil ſhavings; let them boil half away, and put to it two ounces of cherry gum, one ounce of gum arabick, and one ounce of beaten allum; then take it, when all is diſſolved, from the fire; pour it off the ſhavings, and put it up for uſe; you may alſo add to it a little clear chalk.

To prepare Braſil Ink without Fire.

TAKE a new glaz'd pipkin, in which put two handfuls of braſil ſhavings; pour half a pint of vinegar on it, and let it ſtand over night; then put to it a piece of alum, as big as a walnut, with a little gum; take alſo chalk, ſcrap'd fine, about an handful, put it gently, by little and little into the pipkin, and ſtir it well together with a ſtick, and it will begin to boil, as if it was upon the fire: You muſt ſet your pipkin in a clean earthen diſh, before you put your chalk in; for as ſoon as the chalk is in, it will boil over: when this ebullition is over, then put it again into the pipkin, let it ſtand a day and a night, and you will have a fine braſil ink.

To prepare Braſil Ink in Sticks.

TAKE braſil ſhavings, or chips, put them in a pan, and proceed in every reſpect as directed in the foregoing: After the braſil is thus made fit for writing, pour it into ſhells and ſet it in the ſun, where no duſt can come to it, to ſtand a full hour: Then take other ſhells, pour the top of the braſil out of the firſt ſhells into them, and fling the ſettling away; ſet theſe ſhells alſo in the ſun, and after they have ſtood an hour, proceed as before; this do till it is quite purified; then boil it to the conſiſtence of wax, put it up in a nut ſhell, or in a piece of parchment, and you may dilute it with a little wine or fair water, in a little cup, as much as you have occaſion for and write or paint therewith; it is a fine colour, and very fit for colouring maps or prints.

By mixing the braſil ink with a little ground indigo, you have a crimſon or purple; and if with a little white lead, you will have a roſe colour.

To prepare or extract all manner of Lacks out of Flowers.

TAKE flowers, of what ſort or colour you will; if they ſtain white paper, when rubb'd againſt it, they are good: with theſe flowers fill a common, but large head, upon a common cucurbit, that's fill'd with aqua vitæ; put a receiver to it, and lute it well; then diſtill it over a gentle fire, and the ſubtil parts of the ſpirits will fly up into the head, the tincture will be extracted out of the flowers and herbs, and fall into the receiver. This colour'd ſpirit, if diſtill'd in another ſtill; will paſs without any colour, and may be uſed again for the like purpoſes; but the tincture or colour will remain at the bottom of the ſtill, which take out and dry at a gentle heat: In this manner you may make the beſt lack, fit for painters uſe.

Directions for extracting all Sorts of Colours out of Wood, Flowers and Herbs.

WHEN mariners are ſent in ſearch of dyers drugs, wood, or plants, they are adviſed by the merchants to try theſe commodities by chewing them, and ſee whether they colour the ſpittle, which if they do, it is a ſign they are good, and ſuch tryals may alſo be made on white paper or linnen.

The drugs or plants that are known to be good for extraction of colours, are amongſt many others theſe, *Lignum Nephriticum*, or fuſticks, is good for yellow and green colour, *Compegiana*, *Sylveſtre*, &c.

To gild Paper.

TAKE yellow oker, grind it with rain water, and lay a ground with it upon the paper all over; when dry, take the white of eggs, beat it clear with white ſugar-candy, and ſtrike it all over; then lay on the leaf gold, and when dry poliſh it with a tooth.

Some take ſaffron, boil it in water, and diſſolve a little gum with it; then they ſtrike it over the paper; lay on the gold, and when dry they poliſh it.

To make Indian Ink.

BURN lampblack in a crucible, keep it on the fire till it has done ſmoaking: In like manner burn ſome horſe-cheſnuts, 'till no vapour or ſmoak ariſes from them. Diſſolve ſome gum tragacanth to a proper conſiſtence, then mix with it the lampblack and cheſnuts ſtir it well together, and put that paſte into moulds, or form it as you think proper, and then let it dry in a ſhade.

Another.

PUT 5 or 6 lighted wicks into an earthen diſh of oil, hang an iron or tin concave cover over it at a convenient diſtance ſo as to receive all the ſmoak, when there is a ſufficient quantity of ſoot ſettled to the cover, then take it off gently with a feather, upon a ſheet of paper, and mix it up in the manner above directed.

Note. That the beſt and cleareſt oil makes the fineſt, ſoot, and conſequently the beſt Ink.

To prepare Blue Ink.

TAKE elder-berries, preſs the juice thereof into a glaſs, and put powdered allum to it; add to it about its fourth part of vinegar, and a little urin then dip a rag into it, and try whether the colour is to your liking; you may, if it is too pale, add a little more of the juice; and if too dark, of the vinegar to it.

To make good Writing Ink.

IT muſt be obſerv'd, that according to the quantity of ink you deſign to make, the weight and meaſure of the ingredients muſt be either augmented or leſſened: thus for inſtance if you would have 10 quarts of ink, you ought to take four quarts water; ſix quarts of white wine vinegar; three quarts of white wine, and proportion the reſt by weight accordingly.

For a little Quantity:

TAKE one pint of water, one pint and a half of wine, one pint and a half of white wine vinegar, and mix all together; then take ſix ounces of galls, powder'd and ſifted thro' a fine hair ſieve, put them into a pot or bottle by themſelves, and pour on them one half of your mix'd liquor; take alſo four ounces of powder'd vitriol, put it into a bottle by itſelf, and pour half the remaining liquid upon it: To the reſt of the liquor put four ounces of gum-arabick, beaten fine; cover theſe three pans, pots, or bottles, let them ſtand three days, and ſtir every one of them three or four times a day; on the fourth day put the pan with the galls upon the fire, and when you ſee that it is almoſt ready to boil, keep the galls down, and whilſt it is warm, pour it into another veſſel thro' a cloth; do not ſqueeze or wring the cloth, but let it run through of itſelf; then add the liquor which is in the two other veſſels to it, ſtir it well together, let it ſtand three days ſtirring it every now and then; the fourth day, after it is ſettled, pour it through a cloth into a jar or bottle, and you will have good writing ink.

Ink for Parchment.

IS prepared in the ſame manner as the foregoing receipts direct; only to a pint of water, take half a pint of wine and half a pint of vinegar, which together will make one quart of ink. *Or*,

TAKE three or four ounces of powder'd galls, and three or four ounces of gum arabick, put them together into a veſſel with rain water, and when the gum is diſſolv'd, then ſtrain it through a cloth, and add to it near half an ounce of powder'd vitriol. *Or*,

TAKE one pint of beer, put in it one ounce of powder'd gall, let it boil till you ſee it of a reddiſh colour: then add to it ſix drams of green vitriol powder'd, and let it boil again; when you take it off the fire, add ſix drams of gum-arabick, and of allum the bigneſs of a pea, both powder'd; ſtir it till it is cold.

Another Receipt for Writing Ink.

TAKE five ounces of galls, ſix ounces of vitriol, four ounces of gum, and a freſh egg, a little powder of walnuts, two gallons of beer, and put them into an earthen pot; add a little ſal-armoniac, to keep the mixture from moulding. *Or*,

TAKE for one quart of ink, one pint and half a quartern of water, half a quartern of wine, half a quartern of good vinegar, four ounces of vitriol, four ounces of galls, both powder'd by themſelves; then mix them together in a glaz'd veſſel, and pour the 'foreſaid matter upon it, stir it often, during ſix days or more, and when ſettled, pour it into a bottle, and you will have very good ink.

T

To make Ink Powder.

TAKE peach or apricock ſtones, ſweet or bitter almonds, burn them to a black coal in an iron ladle or fire ſhovel; Take likewiſe roſin of a pine tree, put it in a ladle, and make it flame and burn, catching the ſmoak in a little skillet or a linnen canopy you put over it, which after the roſin has done burning, you wipe the ſmoak on a white paper, and put it up for uſe, but to ſave that trouble you may uſe lamp-black; take of the ſaid ſmoak or lamp-black one part, of the coals burnt of the ſtones one part, of vitriol one part; powder of galls, which firſt you fry a little in a ladle with a little oil, two parts; gum-arabick four parts: let all be well mix'd and pounded together, and then keep this powder in a leather bag for uſe and the older it is the better it will be; when you have occaſion to uſe it, temper a little of it with wine vinegar, or water made hot, if you can have it conveniently, if not, you may make ſhift with cold, this powder put into pale ink, will immediately make it black and of a fine gloſs.

To prepare Red Ink.

TAKE two ounces of fine braſil chips; the whites of 12 eggs, and the quantity of a hazel nut of allum; beat the whites of the eggs clear; put them all together in the ſun, or before the fire; ſtir them ſometimes about; ſtrain them through a cloth and let the juice dry well; then keep it from duſt, and when you would uſe it, only temper it with fair water. *Or*,

TAKE the beſt fernumbuca, put it into a cup or pot that is glaz'd, pour good wine vinegar over it, let it ſtand three or four hours to ſoak, then take beer that is clear and bright, mix it with clear pump-water, about an inch above the chips; ſet it on a gentle fire, let it boil, and take care it does not boil over; after it has boiled ſome time, add powdered allum, the quantity of a walnut, to it, and as much gum arabick, ſet it again upon the fire, and let it boil; after it has boil'd a little, take it off, and ſtrain the liquor from the chips; put it into a glaſs, cloſe it up, and you will have a fine red ink.

If inſtead of allum you put a little ſal-armoniac to it, 'twill make the ink look bright.

Yellow Ink.

TAKE the leaves of yellow cowſlip flowers, that grow common in the fields, ſqueeze out the juice, and mix in with allum:

Saffron-water with a little allum makes likewiſe a good yellow. *Or,*

MIX a little allum to ſome ſaffron and water, which makes a very good yellow ink.

To Write Letters or any Thing elſe either with Gold or Silver.

TAKE flint-glaſs or cryſtal, grind it to powder, temper it with the white of an egg; write with it, and when it is dry, take a gold ring, or a ſilver thimble, or any piece of either of thoſe metals, rub your writing therewith gently over and when you ſee the gold or ſilver ſtrong enough, glaze it over with a tooth.

To make Letters of Gold or Silver Emboſſed.

TAKE the juice of garlick, mix it with writing ink or rather with a red or yellow colour for gold. Write therewith your letters or ornaments on vellume or paper, when dry repeat going over them again, ſo as to give them a body; then let it dry; when you lay the gold leaves on, warm the letters with your breath, and cloſe the gold with cotton upon them, it will have a good Effect.

A rare Secret to prepare Gold the Ancient way to Paint or Write with.

TAKE leaves of gold put them in a clean pipkin on the fire ſo as to heat; in another pipkin put four times the weight of the gold near the fire to warm it; this done take both pipkins off the fire, pour the quick-ſilver upon the gold leaves, and immediately ſtir it together with a little ſtick, put it into a diſh full of fair water, and you will have an amalgama, which you may work with ſtrong vinegar or the juice of lemons on a flat ſtone, in order to incorporate it the more, then you kneed and waſh it well with fair water, and ſtrain it thro a lambs skin to bring out the quick-ſilver; then take what remains in the skin, and put to it half as much powder'd brimſtone, mingle it with the ſaid paſte, and ſet it on the fire, in an iron ladle or crucible, leaving it ſo 'till the brimſtone is burned, and all the reſt is of a yellow colour; then let it cool, putting it into a diſh, and waſhing it with fair water, 'till you have a fair colour of gold; then put it up in a glaſs viol, and when you have occaſion to uſe it, dilute it with a little roſe water mix'd with a little gum arabick; and you may paint or write with it as you pleaſe, when dry burniſh it with a dog's-tooth, and it will be of a fine luſtre.

To Write with Gold by a Pen.

TAKE 16 leaves of the fineſt gold, put it upon a colour-ſtone, ſprinkle a little vinegar over it, and let it lie for a little while, then grind it with your muller to a fine powder, put this into a muſſel ſhell, with as much clear water as will fill it, mix it together with your finger, then let it ſettle, and after that pour off the water, and ſupply it with clear water again, ſtir it well with your finger, as before; repeat this till you ſee the water come off from the gold as clear as when put on; after you have thus clear'd your gold, temper as much as you have occaſion for, with a little clean gum water, till you ſee it will eaſily flow from your pen; after your writing is dry, glaze it gently with a tooth.

Fine Red Ink of Vermillion.

TAKE vermillion, grind it fine with clean water, and put it up to keep from duſt; when you would uſe it, take as much as you think you ſhall have occaſion for, and dilute it with a little gum-water. *Or,*

TAKE half an ounce of vermillion, or prepared cinnabar, put it into a galley-pot, take a little powdered clear gum arabick, diſſolve it in water, and temper therewith your vermillion; you may add a little of the white of an egg to it, which beat up till all becomes a ſcum, and when you let it ſtand, the ſettling will be like clear water, which is fit for uſe.

An Artificial Water for writing Letters of Secrecy.

TAKE vitriol, finely powder'd, put a little thereof into a new ink-horn, pour clean water on it, and after it has ſtood a little, write therewith either on vellom or paper, and the writing cannot be ſeen any other way, than by drawing the letter through a water, which is thus prepar'd: take a pint of water, put into it one ounce of powder'd galls, temper it together, and ſtrain it through a cloth, put the water into a diſh that's wide enough and draw your writing through it, and you will read it as you do other writings; and to make the ſecret contents leſs liable to ſuſpicion, you may write on the contrary ſide of the paper or parchment with black writing ink, matters of leſs conſequence.

Another Secret, to write a Letter white upon white, which cannot be read but in fair Water.

TAKE clean allum, beat it to a fine powder, mix it with water, ſo as not to be too thin; then take a new pen, and with this mixture write what you pleaſe upon paper, and let it dry; then let him, who is to read it, lay the letter into a flat baſon or diſh, that is fill'd with clean water, and in a quarter of an hour the letters will appear white upon white, ſo that they may be plainly ſeen and read. *Or,*

TAKE the juice of onions, write with it, he who would read it, muſt hold it over the fire, and the writing will turn of a reddiſh or browniſh colour.

The Manner of marbling Paper or Books.

TAKE clear white gum tragant, put it into an earthen pan, pour freſh water to it, till it is two hands high over the gum, cover it, let it ſoak 24 hours, then ſtir it well together; add more water to it; keep it often ſtirring for a

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PLATE .V.

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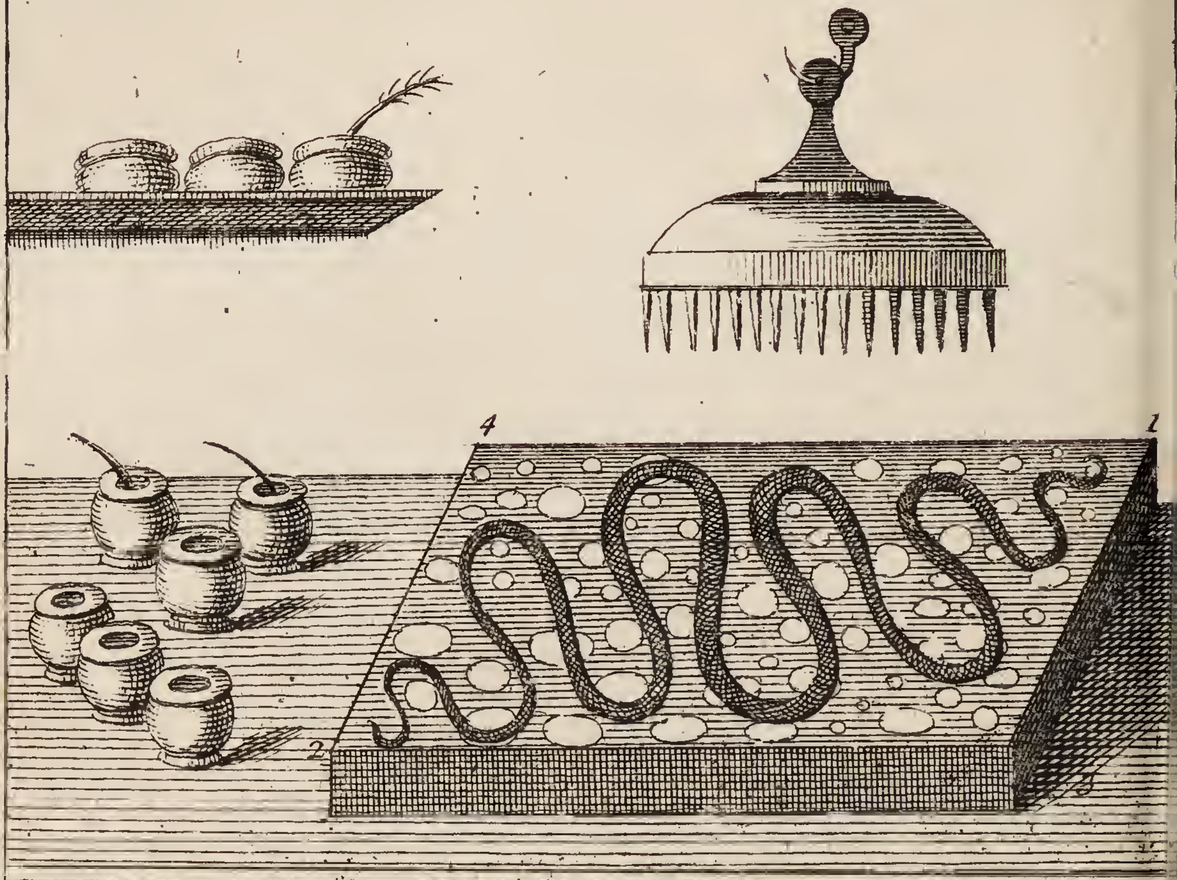

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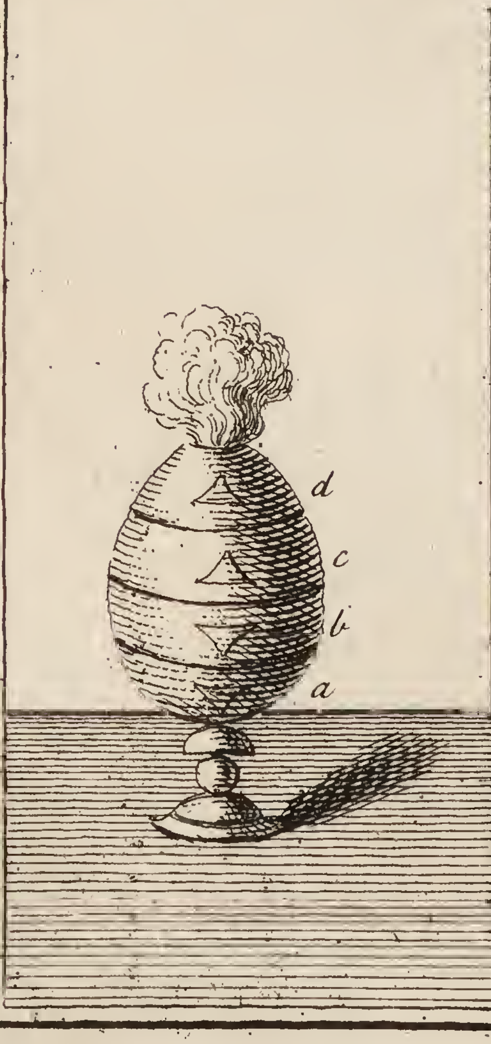

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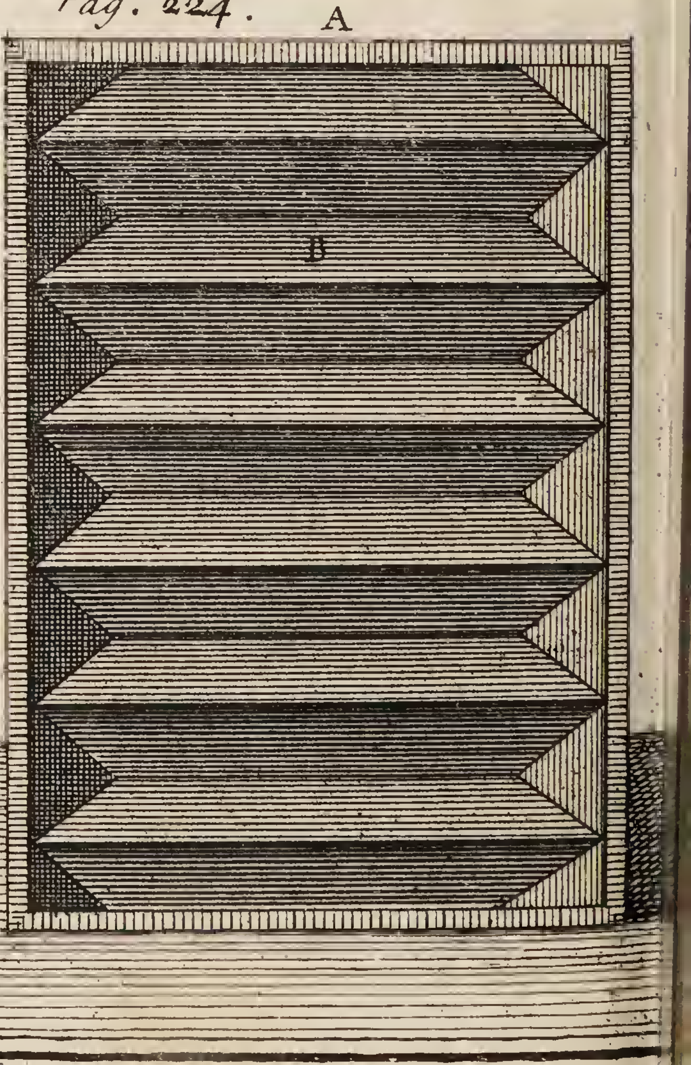

whole day, and it will ſwell; keep it ſtiring ſeveral days, according as you find your gum is freſh or ſtale, for the freſh will diſſolve ſooner than that which has lain by a long time. Keep it now and then ſtiring, when you find it well diſſolv'd, pour it through a collender into another pan, add to it more water, and after it has ſtood a little, and been ſtirr'd about, ſtrain it through a clean cloth into another clean pan; keep it well covered, to hinder the duſt or any other thing from coming to it; this water, when you go to make uſe of it in marbling your paper or books, muſt be neither two thick nor too thin; you may try it with your comb, by drawing the ſame from one end of the trough to the other; if it ſwells the water before it, it is a ſign that it is too thick, and you muſt add in proportion a little more water.

Your trough muſt be of the largeneſs of your paper, or rather ſomething wider, and about four inches deep.

After you have fill'd your trough with the 'foremention'd water, and fitted every thing for the work, then (before you lay on your colours) take a clean ſheet, and draw the ſurface, which will be a thin ſort of film off on it; then have your three colours, namely indigo mixt with white lead, yellow oaker, and roſe pink, ready prepared at hand, and for each colour have two galley-pots in order to temper them, as you would have them in different ſhades.

All your colours muſt be ground very fine with brandy.

The blue is eaſily made deeper or lighter, by adding more or leſs white lead.

The yellow uſed for that purpoſe, is either yellow orpiment or *Dutch* pink.

For blue, grind indigo, and white lead, each by itſelf, in order to mix that colour either lighter or darker.

For green, take the 'foreſaid blue and white, add ſome yellow to it, and temper it darker or lighter, as you would have it.

For red, take either lake, or roſe pink.

Every one of theſe colours are, as we ſaid before, firſt ground very fine with brandy, and when you are ready to go to work, add a little ox or fiſh-gall to them; but this muſt be done with diſcretion, and you may try them by ſprinkling a few drops upon your gum-water; if you find the colour fly and ſpread too much about, it is a ſign of too much gall, which to remedy, add more of the ſame colour which has none, but when you ſee the colour ſpread and retract itſelf again gently, it is right.

When thus you have your colours and all things in good order, then take a pencil, or the end of a feather, and ſprinkle or put firſt your red colour ; then the blue, yellow, green, &c. begin your red from N° 1, and go along your trough to N° 2; alſo the blue from N° 3, all along to N° 4. The yellow and green put here and there in the vacant places; then with a bodkin or a ſmall skewer, draw a ſort of a ſerpentine figure thro' the colours, beginning from N° 1, to N° 2 : when this is done then take your comb and draw the ſame ſtraight along from N° 1, to N° 2. If you would have ſome turnings or ſnail-work on your paper, then with a bodkin give the colours what turns you pleaſe. See the plate.

Thus far you are ready in order to lay on your paper which muſt be moiſtened the day before, in the ſame manner as book-printers do their paper for printing ; take a ſheet at a time, lay it gently upon your colours in the trough, preſs it ſlightly with your finger down in ſuch places where you find the paper lies hollow ; this done, take hold at one end of the paper, and draw it up at the other end of the trough, hang it up to dry on a cord, when dry, glaze it, and it is done. You may alſo embelliſh your paper with ſtreaks of gold, by applying muſſel gold or ſilver, tempered with gum-water, among the reſt of the colours.

To Silver Paper, after the Chineſe manner without Silver.

TAKE two ſcruples of clear glue, made of neats leather, one ſcruple of white allum, half a pint of clean water ; ſimmer it over a ſlow fire 'till the water is conſumed or the ſteam ceaſes: Then your ſheets of paper being lay'd on a ſmooth table, you dip a pretty large pencil into that glue, daub it over as even as you can, repeat this two or three times, and then you ſift the powder of talk through a fine ſieve made of Horſe Hair or gauſe, over it, and then hang it up to dry, and when dry, rub off the ſuperfluous talk, which ſerves again for the ſame purpoſe : The talk you prepare in the following manner.

Take fine white tranſparent talk, that comes from *Muſcovy*, boil it in clean water for four hours, then take it off the fire and let it ſtand ſo for two days: then take it out, waſh it well, and put it into a linnen rag, and beat it to pieces with a mallet: To ten pound of talk, add three pound of white allum, and grind it together in a little hand mill, then ſift it through a gauze ſieve, and being thus reduced to a powder, put it into water and juſt boil it up. Then let it ſink to the bottom, pour off the water from it, place the powder in the ſun to dry, and it will become a hard conſiſtence. This beat in a mortar to an impalpable powder, and keep it, for the uſe above-mentioned, free from duſt.

To prepare Ink, ſo that what is writ therewith cannot be read but in a dark Place.

TAKE half a pint of goat's milk, a ſweet apple peeled and cut, a handful of touchwood, which in the night-time ſeems to ſhine; put this and the apple into a mortar, beat them together, pouring now and then a little of the goat's milk to it; after it is well beaten, pour the reſt of the milk to it, ſtir it well together, then wring it through a cloth, with this liquor write what you pleaſe, and if you would read it, go into a dark cellar or chamber, and the writing will appear of a fiery or gold colour.

To make fine red Paper.

TAKE a pan full of water, put ſome quick-lime into it, to make it into a lee, and let it ſtand over night; then put braſil chips into a clean pot, about half full, fill it with the lees, and boil it to half; and when it is juſt hot, add to it a little allum: when you would uſe it, mix it with a little gum or ſize, and then with a pretty large pencil lay your colour on the paper with an even hand.

To prepare Ink for drawing of Lines, which when writ upon, may be rubbed out again.

BURN tartar to aſhes, or till it is calcined, to a white colour; take thereof the bigneſs of a hazle nut, and lay it into a cup full of water to diſſolve, then filtrate it; To this ſolution mix as much fine ground touch-ſtone, as will colour it black enough to write with: with this ink rule the lines you would write upon; when you have done writing, only rub it over with the crumb of a ſtale rowl, or with crumb of bread; the lines will vaniſh and the paper be as clean as it was before. This may be uſeful for ſchools.

To write ſo that the Letters may appear White, and the Ground of the Parchment Black.

TAKE clean water, temper it with the yolk of an egg ſo as to write therewith; with this write upon your vellum, or parchment, what you pleaſe, let it dry and draw it through ink, ſo that it may take every where; or ſtrike it over with a large ſoft pencil to make it of a good black; when it is thorough dry, then ſcrape it gently off with a knife, and your writing will appear as white as the parchment was, before you wrote upon it.

To make Oil Paper.

TAKE the ſhreds of parchment, boil them in clear water till it is clammy, and like a ſtrong glue, ſtrain it through a cloth, and with a large pencil ſtrike it over the paper; when dry, varniſh it over with a varniſh of turpentine, or the *Spaniſh* varniſh mentioned in the firſt article under this head.

Choice Secrets for CABINET-MAKERS and TURNERS.

To prepare a black Colour for ſtaining Wood.

PUT two ounces of iron filings into a new earthen pan; add to it one ounce of ſal-armoniac, diſſolved in a quart of vinegar, and let it ſtand 12 days, the longer it ſtands the better it will be; then take raſped logwood, and three ounces of gallnuts, pounded fine; infuſe this in a quart of lee made of lime, let this alſo ſtand the ſame time as the above.

When you have occaſion to uſe it, warm both thoſe liquors over a ſlow fire, and with the lee firſt ſtrike the wood over you deſign to dye, and then with vinegar; repeat this till you ſee the wood black enough to your liking; after which, wax the wood over with bees-wax, and rub it with a woolen rag, and it will look bright and fine.

To imitate Ebony Wood:

TAKE clean and ſmooth box, boil it in oil till it turns black; *Or*,

Take ſmooth plained pear-tree wood, ſtrike it over with aqua fortis, and let it dry in a ſhady place, in the air; then wipe it over with good black writing ink, let it alſo dry in the ſhade; repeat and wipe the ink over it, till the black is to your liking. Then poliſh it with wax and a woolen rag.

Another, but more coſtly Method.

DISSOLVE one ounce of fine ſilver in one pound of aqua fortis; add a quarter of a pint of clear water to it, with this ſtrike your wood over; repeat it till you perceive it to be as black as velvet, then poliſh it with wax.

Another Method.

TAKE what ſort of wood you pleaſe, box, cedar, mulberry, pear-tree, and the like; ſteep it for three days in allum-water, in a warm place, or if it be ſummer, in the ſun; then boil it to oil, in which mix ſome vitriol and ſulphur; the longer you boil it, the blacker the wood will be; however you muſt not let it boil too long, leaſt it ſhould be ſcorched. *Or*,

STRIKE your wood over with ſpirit of vitriol, hold it over a coal fire, and repeat this till it is black enough; then poliſh it. *Or*,

IRON filings ſteep'd in beer and urine, will make a good black. *Or*, PUT one pound of raſped braſil in a clean pan, boil it in three pints of ſtrong white wine vinegar, till the half is boiled away, then pour it clear off; take alſo one pound of bruiſed gallnuts, put them into another pan with water, and let them ſtand for eight days in the ſun to ſoak; then put to it eight ounces of vitriol, ſtir it together, and let it ſtand for two or three days; pour it off clear; and add to this liquor the fourth part of the prepared braſil, and with this ſtrike your wood over 20 or 30 times running, let it every time dry in the ſhade.

Then take fine ſilver, as much as you pleaſe, diſſolve it in common aqua fortis, add to it twice the quantity of ſpring-water: with this ſtrike over the dy'd wood once or twice, ſet it in the air to dry, and it will be of a fine coal black; after which poliſh it as before directed.

An excellent Secret to dye Wood of any Colour.

PUT freſh horſe-dung, the moiſteſt you can get, upon ſome little ſticks laid acroſs one another over an earthen pan, which is to receive the liquor that drops from the dung; ſupplying it with freſh dung every time it is drain'd 'till you have a ſufficient quantity. Then divide the liquor in as many pots as you intend colours, put in each pot the bigneſs of a horſe-bean of alum, and as much gum arabick, then ſteep what colour you will in that liquor, and put in the pieces of wood, which after it is ſtain'd to your liking you take out to dry, the longer you let it remain in the liquor the deeper will be the colour, by this means you may ſhade your wood from a deep to a light colour, which will penetrate ſo, as never to fade or vaniſh.

To dye Wood of a Red Colour.

TAKE one handful of quick-lime; two handfuls of aſhes, put them together into rain-water, and let them ſoak for half an hour, till they are well ſettled, and you have a good lee. Then take a new pan, in which put one pound of fernambuca, pour on it the ſaid lee, and after it has ſoaked for half an hour, let it boil, and when it is cold, pour it off into another clean pan, and fling one ounce of gum arabick into it;

take another earthen pan with rain-water, put into it two ounces of allum, boil your wood in it, and after it is well ſoaked, take it out, let it cool a little, warming the mean while the red colour, and ſtriking it over your wood; repeat this till your colour is deep enough to your liking, then poliſh it with a dog's tooth.

Another Red, for dying Wood.

TAKE raſp'd braſil, boil it till you ſee it of a fine red colour, then ſtrain it through a linnen cloth.

The Wood you deſign to dye, colour firſt over with ſaffron yellow, and after it is dry, ſtrike it over with the red colour, till it is deep enough; then poliſh it with a tooth. If you put a little allum to the braſil colour, it will turn to a brown.

To etch Figures upon Wood.

TAKE melted tallow, and having your Table ready, form therewith flowers, or what elſe you will, upon it; then with a colour'd water boil'd with vitriol, ſaltpetre and allum in ſtanding miſt-water, with which cover the board over the tallow; and let it ſtand, or repeat it till the colour pleaſes you. In this manner you may marble or clow'd your wood as you pleaſe your ſelf.

To marble upon Wood.

TAKE the whites of eggs, beat them up till you can write or draw therewith, then with a pencil or feather draw what veins you pleaſe upon the wood; after it is dry'd and harden'd for two hours, take quick-lime, mix it well together with wine, and with a bruſh or pencil paint the wood all over; after it is thorough dry, rub it with a ſcrubbing bruſh off ſo, that both the lime and the whites of the eggs may come off together; then rub it with a linnen rag till it is ſmooth and fine; after which you may lay over a thin varniſh, and you will have a fine marbled wood. *Or,*

GRIND white lead or chalk together with water upon a marble very fine, then mix it up with the whites of eggs well beaten, wherewith you may paint or marble as you think proper; when dry, ſtrike it over with a lee made of lime and urine, this will give the wood a brown-red colour; upon this colour you may, when dry, marble again with the whites of eggs, and again when dry, give it another bruſh with the lee; after you have with a ſcrubbing bruſh rubb'd off the marbling whites of eggs, then you may ſtrike it once more all over with the lee, and your work, when dry and poliſhed, will look very agreeable and of a fine marbling.

A Gold, Silver, or Copper Colour on Wood.

TAKE cryſtal, beat it in a mortar to powder, then grind it on a marble with clean water, and put it into a clean new pot, warm it, and add to it a little glue, with this ſtrike or paint over your wood: when dry, take a piece of gold, ſilver or copper, and rubbing it over therewith, you will have the colour of any one of thoſe metals upon the wood, which you may afterwards poliſh.

To colour Wood of a Walnut-tree Colour.

TAKE the bark of walnut-trees, or the green ſhells of walnuts, dry them in the ſun, mix as much as you have occaſion for, with nut-oil; boil it up, and rub the wood over therewith.

To ſtain Wood of a fine Green.

TAKE green nut-ſhells, put them into a lee made of *Roman* vitriol and allum, in which let them boil an hour or two. To this lee add ſome verdegreaſe, finely ground with vinegar, then take your wood, after you have ſoak'd it for two days in ſtrong white wine vinegar, and boil it therein. *Or,*

TAKE the fineſt verdegreaſe, grind it with ſharp wine vinegar, add to it a little tartar; let it ſtand over night, the verdegreaſe will ſettle, and you will have a fine green; with this ſtrike over your wood ſeveral times: If you would have it of a graſs green, then put a little ſap green amonſt it.

A Red Colour for Wood.

TAKE quick-lime, pour rain-water upon it; let it ſtand over night, and filter it through a cloth; then add more rain-water to it, and put in clear and freſh braſil chips, together with the wood you intend to dye, and boil it till the colour is to your liking. The wood is firſt to be throughly ſoaked in allum water. *Or*,

POLISH your wood-work, after you have finiſhed it with your plane, and then lay on it muſſel gold or ſilver, diluted with ſize or with the white of an egg; marbling it in the manner above directed in marbling of wood, and when dry, ſtrike it over ſeveral times with the following colour.

Take fine raſped braſil, pour on it oil of tartar, or infuſe it therein, and it will extract a fine red colour: this colour'd oil pour off, and put freſh oil to the braſil, to extract more of the colour. Let theſe extractions dry gently, then draw it off again with ſpirit of wine, and you will have a red for your uſe.

A Violet Colour for Wood.

TAKE four ounces of braſil, and one ounce of indigo, infuſe them together in a quart of water, and boil your wood therein.

To adorn Wood with Ornaments of Silver or Tin.

FIRST carve or hollow your ornaments out upon your wood in the beſt manner, ſo as to undermine the edges on both ſides of your ſtrokes. Then make an amalgama of tin, by diſſolving it over a gentle heat, and putting into it the ſame quantity of quickſilver, which, before you have heated, ſtir with a ſtick well together, and pour it into a pan of cold water; when dry, grind it upon a marble with water very fine, tempering it with clear ſize; then fill up the carved figures, ſmoothing it with your hand, and when dry poliſh it. To make it more of a ſilver colour, rub it over with an amalgama of ſilver and quickſilver, and poliſh it with a dog's tooth.

Inſtead of tin, you may alſo uſe biſmuth ground fine with water.

To Emboſs or Trace all Manner of Ornaments on a gilded ſmooth Pannel, the Gold being laid over with Black or any other Colour.

FIRST gild your pannel or other wood work, as you are directed under the article of gilding, and when thoroughly dry, paint it all over ſmooth and even with lampblack, ground with linſeed and nut-oil; add to it an equal quantity of umber, in order to dry it the better; after you have ſet it for two or three days, or according to the conveniency or the time of the year, to dry; then, before it is quite hard, draw or pounce what you deſign to emboſs upon, and with a blunt-pointed bodkin, horn, or wood, trace into the black lay, down to the gold, opening thoſe places, and making the gold appear in the beſt manner you can. In birds, plants, cattle, and ſuch like, you muſt obſerve to take the heightenings out clear, and leave the ſhade, by hatching into the black, agreeable to your deſign; the fine and ſoft ſhades of the hair, *&c.* you may finiſh with a fine pencil, with the black colour, upon the gold; and when you have done, let it dry thoroughly for three or four days more; then lay over it a clear varniſh, which you may, after it is dry'd, repeat a ſecond time, and your work will look beautiful.

To do this upon a Blue Ground.

AFTER you have gilded your work, then take allum which is not too coarſe, mix it with mortar on a marble ſtone, adding to it the white of an egg: with this and a little water mix your ſmalt, and ſtrike it fine and even over the gilding: then, when it is almoſt dry, ſift through a fine ſieve ſome of the fineſt ſmalt over it: you may, if you will, mix it with ſpangles of ſeveral colours; and when thoroughly dry, wipe off what ſticks not to it, and proceed in tracing up your figures you deſign for gold. The fine finiſhing ſtrokes upon the gold, becauſe they cannot well be done with ſmalt, you may uſe *Pruſſian* blue or indigo mix'd with white lead. You may, if you will, varniſh it, but it will look better without.

Varieties of GLUES and CEMENTS, for joining not only WOOD, but alſo STONE, GLASS, and even METALS.

An excellent Glue for Wood, Stone, Glaſs, and Metals.

TAKE good glue four ounces, ſoak it over night in diſtill'd vinegar, then boil it up therewith; take a clove of garlick, beat or bray it in a mortar, add to it one ounce of ox-gall. Wring this juice through a linnen cloth into the warm glue; then take maſtic and ſarcocolla, of each one dram, ſandarac and turpentine of each two drams; grind the ſandarac and maſtic fine, and put them together with the ſarocolla and turpentine into a phial; pour one ounce of the ſtrongeſt brandy upon it, and let it ſtand three hours in a moderate heat, well ſtopp'd up, giving it now and then a ſhake, add this alſo to the warm glue; then ſtir or beat it together with a wooden ſpatula, 'till ſome of the moiſture is evaporated, and the glue is grown cold. When you have occaſion to uſe it, then take as much or as little as your work requires, ſoak it in ſtrong vinegar, 'till it is diſſolv'd. If you uſe this glue for ſtones, mix it with tripoli, or with ſome powdered chalk; and if for glaſs mix beſides a little tripoli, fine ground *Venice* glaſs; and if you would uſe it for metals, as iron, braſs, copper, put to it ſome of the fineſt filings; you may alſo add a little iſinglaſs. And if you would have this glue hold out or ſtand the water, mix it up with a ſtrong varniſh as much as the preſent occaſion requires.

A good Stone Glue or Cement for Grotto-Work.

TAKE two parts of white roſin, melt it clear, add to it four parts of bees-wax; when melted together, add ſtone-flower, of the ſtone you deſign to cement, two or three parts, or ſo much as will give the cement the colour of the ſtone; to this add one part of flower of ſulphur, firſt incorporate all together over a gentle fire, and afterwards knead it with your hands in warm water. With this cement the ſtones, after they are well dry'd and have been warm'd before the fire, in order to receive the cement the better.

A Wood Glue, which ſtands Water.

COMMON glue mix'd up with linſeed oil or varniſh, applied to the places to be glewed together, after they have been warm'd, and when thoroughly dry, will laſt and ſtand water.

Another fine Glue.

TAKE iſinglaſs and common glue, ſoak them over night in ſtrong brandy; then diſſolve them over a coal fire, and mix with it a little fine powder'd chalk; this will make a very ſtrong glue.

Another extraordinary Glue.

TAKE ſal-armoniac, ſandarac and gum-lacca, ſoak and diſſolve them in ſtrong brandy, over a gentle heat, put to them a little turpentine; when all is diſſolv'd, then pour the ſolution over iſinglaſs and common glue, and in a cloſe veſſel, diſſolve it over a ſlow fire; add to it a little glaſs-duſt, and when it is of a right temper, uſe it.

A good Water Cement.

TAKE one part of minium or red lead, and two parts of lime; mix them well together with the whites of eggs.

Stone-Glue, wherewith you may glue either Stone or Glaſs.

TAKE white flintſtone powder, which is dry and finely ſearced; then take white roſin, melt it in an iron or earthen ladle, ſtir the powder in it, 'till it is like a thick paſte; warm the glaſs, or what you deſign to glew together, gild the places or joinings, and it will add a great beauty. This has been made uſe of in the embelliſhment of cabinets, and other things.

An exceeding fine Cement to mend broken China or Glaſſes.

GARLICK ſtamped in a ſtone mortar, the juice whereof, when applied to the pieces to be join'd together, is the fineſt and ſtrongeſt cement for that purpoſe, and will leave little or no mark, if done with care.

A Cement for broken Glaſſes.

BEAT the white of an egg very clear, mix with it fine powdered quick-lime, with this join your broken glaſſes, china and earthen ware. *Or,*

TAKE iſinglaſs, powder'd chalk, and a little lime, mix it together, and diſſolve it in fair water over a ſlow fire, with which cement your broken glaſſes or china ware, and ſet it to dry in the ſhade. *Or,*

TAKE iſinglaſs, maſtix and turpentine, diſſolve them, and cement your broken ware; when dry they will hold, and rather break in another place, than where join'd and cemented. *Or,*

TAKE quick lime, mix it with old cheeſe, which before you have boil'd in water to a paſte; with this cement your glaſſes or china, and it will anſwer your deſire. This paſte is likewiſe a good *lutum*; to lute a cover to an earthen pan, or a glaſs, retorts, *&c.* You may add a little fine brick-duſt to it.

A Lutum or Cement, for Cracks in glaſſes uſed for chimical preparations. This will ſtand the fire.

TAKE wheat-flower, fine powder'd *Venice* glaſs, pulverized chalk of each an equal quantity; fine brick-duſt one half of the quantity, a little ſcrap'd lint; mix it up with the white of an egg, ſmear it on a linnen cloth like a plaſter, and with it encloſe the cracks of your glaſs retort, or other glaſs utenſil; but let it dry before you put it to the fire. *Or,*

TAKE old varniſh, glue therewith your pieces together, tie it cloſe, and ſet it to dry in the ſun, or a warm place;

when dry, ſcrape off the varniſh that is preſs'd out at the ſides, and it will hold very well.

To join broken Amber.

ANoint the pieces with linſeed oil, join and hold them cloſe together over the fire.

An excellent Glue or Cement to mix with Stone, Glaſs, Marble, &c. in order to make Utenſils, Images, and other Things therewith.

TAKE fine glue well purified, four ounces; maſtick two ounces, powdered ſealing wax ſix ounces, fine ground brick-duſt one ounce; put the fiſh glue into a glaz'd pipkin upon a ſlow fire; and after you have mix'd your ingredients, put it together into the pipkin, boil it up, and what hangs together uſe; if you mix it up with fine powdered glaſs, of any colour, you may form it to what ſhape you will, and when cold and dry, it will be as hard as ſtone.

Another Cement which dries quickly.

TAKE pitch, as much as you will, melt it, and mix it with brick-duſt and litharge, and to make it harder, moiſten the brick-duſt firſt with ſharp vinegar, and take a larger quantity of the litharge, it will be as hard as ſtone.

Good Glue Sticks, or Spittle Glue, fit for Bookbinders.

TAKE two ounces of iſinglaſs, half an ounce of ſugar-candy, and half a dram of gum tragant. Then take half an ounce of ſlips or parings of white parchment, pour on it a pint of water, and let it boil well; take that water, ſtrain it through a cloth, and pour it over the two other ingredients, mix'd with a little roſe water; let it boil away above half, then take it off the fire, and caſt it into little flat ſticks, or in any ſhape you pleaſe.

Water Cement, which the longer it is in Water, the harder it grows.

TAKE maſtick, incenſe, roſin, and fine cut cotton, of each an equal quantity, melt, and with ſome powder'd uick-lime, mix them up into a maſs.

A Cement as hard as Iron.

MELT pitch, then take ground ſand, worn off from grind ſtones, ſtir them well together, boil it up, and it fit for uſe.

Several curious Secrets relating to IVORY, BONE, and HORN.

To whiten Ivory that is become red or yellow.

PUT allum into fair water, ſo much as will make it pretty white, then boil it up; into this put your ivory for an hour to ſoak; rub it with a hair cloth, and wipe it over with a clean napkin or linnen rag moiſten'd; in this let it lie, ill it dries of itſelf, elſe, it will be apt to ſplit.

Another Method to whiten Green Ivory.

BOIL the ivory in water and quick-lime, till your ſee it has a good white.

To Marble upon Ivory.

MELT bees-wax and tallow together, or elſe yellow and white bees-wax, and lay it over your ivory; then with an ivory bodkin, open the ſtrokes that are to imitate marbling; pour the ſolution of ſome metal or other on them, and let it ſtand a little while; then pour it off, and when it is dry, cover thoſe ſtrokes again with wax, and open ſome other veins with your bodkin for another metallic ſolution; and this repeat to the number of colours you deſign to give it.

the ſolution of gold gives it a purple; of copper, a green of ſilver, a lead black; of iron, a yellow and brown colour. Theſe ſolutions well manag'd, and apply'd on ivory, will intirely anſwer the deſign of the artiſt.

By this method you may imitate tortoiſe-ſhell, and ſevera other things on ivory.

To ſtain Ivory of a fine Green.

TAKE to two parts of vardegreaſe one part of ſal-armoniac; grind it well together, pour ſtrong white win vinegar on it, and put your your ivory into it; let it lie covered till the colour has penetrated, and is deep enough to your likeing. If you would have it marbled or ſpotted, ſprinkle o marble it with wax.

And thus you may colour your ivory with any other colours if you prepare them in the manner directed, *viz.* with ſal-armoniac and vinegar.

To dye Ivory or Bone of a fine Coral Red.

MAKE a lee of wood-aſhes, of which take two quarts pour it in a pan upon one pound of braſil, to this ad one pound of allum, two pounds of copper filings, and boil i for half an hour; then take it off, and let it ſtand: in this pu the ivory or bone, the longer it continues in this liquor, th redder it will be.

To ſtain Ivory or Bone of a Black Colour.

TAKE litharge and quick-lime, an equal quantity of each put them in rain-water over the fire, till it begins t boil. In this put the bone or ivory, ſtirring them well abou with a ſtick; and afterwards when you ſee the bone receiv the colour, take the pan from the fire, ſtirring the bone a the while, till the liquor is cold.

To dye Bones of a Green Colour.

TAKE a pan full of clean water, and put into it a prett large piece of quick lime, leaving it ſo for 24 hours then ſtir it well together with a ſtick, and when ſettled ſtir again, thus repeating it three or four times; the next morning ſtrain it off clean and put it up for uſe; the Bones you intend to dye boyl in common water wherein allum has been diſſolv'd, for ſome time then ſcrape them well, and put them into the lime water mixt with verdegreaſe, boil them well, and then take them out to dry; inſtead of lime water you may make uſe of urine, which will anſwer the ſame purpoſe.

To dye Bones or Ivory the Colour of an Emerald.

PUT copper-filings or flacks into ſome aqua-fortis, and when it has done working, put in your wrought bone or ivory, leaving it therein for 24 hours, then take it out and it will be of a pleaſant Emerald-Colour.

To dye Bones, red, blew, or any other Colour.

FIRST boil the bones in allum water, then take quick-lime-water or urine, put into it braſil, lackwood, or madder, or whatever colour you pleaſe; then boil the bones or ivory therein, and it will anſwer your purpoſe.

To make Horn ſoft.

TAKE man's urine, which has been put by and cover'd for a month; in this boil one pound of weed-aſhes, or the aſhes of vine-ſtalks, two pound of quick-lime, eight ounces of tartar, and eight ounces of ſalt; after it is boil'd pour it through a flannel, and filtre it thus three times. Keep this lee covered, and ſoak the horn therein for eight days, and it will be ſoft.

Another.

TAKE weed-aſhes and quick lime; of this make a ſtrong lee, filtre it clear, and boil the ſhavings or chips of horn therein, and they will be like a paſte; you may colour it of what colour you pleaſe, and caſt or form it into any thing you pleaſe.

To prepare Horn Leaves in Imitation of Tortoiſe-Shell.

TAKE quick-lime one pound, and litharge of ſilver eight ounces; mix it with ſome urine into a paſte, and make ſpots with it, in what form or ſhape you pleaſe, on both ſides of the horn; when dry, rub off the powder, and repeat this as many times as you will. Then take vermillion, which is prepared with ſize, lay it all over one ſide of the horn, as alſo on the wood, to which you deſign to faſten it.

For raiſed work, form the horn in a mould of what ſhape ſoever: put it by to dry, and with the aforeſaid paſte and the vermillion give it the colour; then lay on a clear glue (neither too thick, nor too thin) both upon the horn and the wood on which it is to be fixed, and cloſe it together; do this work in a warm place; and let it ſtand all night, then cut or file off the roughneſs, or what is ſuperfluous about it; rub it over with a coal, and poliſh it with tripoli and linſeed oil.

The work made in this manner looks very beautiful and natural, and may be uſed by cabinet makers for pillars, pilaſters, pannels, or any other embelliſhment in cabinet-work.

Another Method to Counterfeit Tortoiſe-Shell on Horn.

TAKE good aqua-fortis two ounces, fine ſilver one dram; let the ſilver diſſolve, and after you have ſpotted or marbled your horn with wax, ſtrike the ſolution over it; let it dry of itſelf, and the horn will be in thoſe places, which are free from wax, of a brown or black colour. *Or,*

Lay the wax all over the horn, then with a pointed skewer or iron draw what you will, laying the figure you draw open on the horn; then pouring on the above ſolution, let it ſtand a little; and after you have pour'd it off, either ſcrape or melt the wax, wipe it with a clean rag, and poliſh it.

Inſtead of the ſilver ſolution, you may boil litharge of ſilver in a ſtrong lee made of quick-lime, ſo long till it becomes of a black tincture: Or, inſtead of ſilver you may diſſolve lead in aqua-fortis:

To

To ſolder Horn together, after it has been lin'd with proper Foils or Colours.

TAKE two pieces of horn, made on purpoſe to meet together, either for handles of knives, razors, or any thing elſe; lay foils of what colour you pleaſe on the inſide of one of the horns, or inſtead of foils painted or gilded paper or parchment; then fix the other piece upon it; lay a wet linnen fillet, twice doubled, over the edges, and with a hot iron rub it over, and it will cloſe and join together as firm as if made of one piece.

To dye Horn of a Green Colour.

TAKE two parts of verdegreaſe, one third part of ſal-armoniac, grind it well together, pour on it ſtrong white wine vinegar, and it will be tinctured of a pleaſant green: then put your horn into it, let it lie therein till you ſee it tinged to what height of colour you would have it. *Or,*

TAKE the green ſhells of walnuts, put them into a ſtrong lee, with a little vitriol and allum, let it boil for two hours, and lay the horn for two days in ſtrong vinegar; then put half an ounce of verdegreaſe, ground with vinegar, into the lee, boil the horn in it, and it will be of a fine green.

To dye Horn of a red Colour.

TAKE quick-lime, pour rain-water upon it, and let it ſtand; filtre it through a cloth, and put to it one quart of clean water, and two ounces of ground braſil-wood; ſteep the horn therein, then boil it, and you will have a fine red, if before you have ſoak'd it for a while in allum water.

To ſtain Horn of a Brown Colour.

TAKE quick lime, ſlacken it with urin, and wipe it over the horn; then take red curriers water, waſh the horn therein, and it will turn to a green colour; wipe it over again with the ſaid lime, and when dry, waſh it with lee; let it lay therein a whole day, it will be of a fine cheſnut colour.

To dye Horn of a Blue Colour.

TAKE a braſs bowl, and when you have made it red hot, wipe it over with ſal-armoniac; then pour lime water upon it, ſtir it together, and you will have a blue water, in which ſteep your horn; the longer you let it lie, the deeper will be the colour.

OF VARNISHING or JAPANNING on WOOD, &c.

A white Varniſh.

TAKE ten ounces of rectified ſpirits of wine, and fine pulverized gum ſandarac two ounces, clear *Venice* turpentine two ounces, put it together into a glaſs, and cover it cloſe with wax'd paper and a bladder; then take a pot with water, put it on a coal fire, and when it begins to be warm, put ſome hay on the bottom of the pot, on which ſet your glaſs; then let it boil for two or three hours, and the ſandarac and turpentine will diſſolve, and unite with the ſpirits: Then pour your varniſh boiling hot through a clean hair cloth, and put it up in a clean phial for uſe. This is an excellent varniſh, fit to be uſed for varniſhing light colours, as white, yellow, green, sky, red; alſo ſuch things as are ſilvered or gilded.

Another Varniſh fit to mix with red or dark Colours, and to japan the Work over therewith.

TAKE rectified ſpirits, that is, ſuch as when pour'd on gun-powder will fire it; or when a linnen rag being dipp'd into it, and lighted it will conſume it, one pound; of clean gum lacca a quarter of a pound; grind it fine, and put it into a phial; then pour the ſpirits over it, let it ſtand for two days, ſhaking it once every hour; the third day hang it over a gentle coal fire till it is well diſſolved, then ſtrain it through a hair bag, and put it up for uſe.

Another Lac Varniſh.

TAKE of the beſt and ſtrongeſt brandy one quart, calcin'd tartar one pound, let the brandy ſtand upon the tartar, cloſe covered, for one day, in a gentle warmth; then pour off the brandy and filtrate it through a paper; of this take one pound, white amber ſix ounces, ſandarac ſix ounces, gum lac two ounces (the amber muſt be picked out of clear pieces) grind all fine together, put it into a phial or matraſs, then pour on it three pound of the filtrated brandy; your phial muſt be but about half fill'd; then ſhake it about for an hour together, keep it in the matraſs for two days, ſhaking it once every hour; when ſettled, pour it through a hair cloth, and it is fit for uſe.

What ſediment remains in the phial, may be uſed in making another ſuch quantity of varniſh, adding to it but half the quantity of freſh ingredients.

Another Lac Varniſh.

TAKE highly rectified ſpirits of wine one pint, gum lac four ounces, ſandarac two ounces, white amber one ounce, white frankincenſe one ounce: powder theſe in a ſtone mortar very fine, and put them together with the ſpirits of wine, into a phial or matraſs, ſtopping it very cloſe; ſet it in the heat of the ſun, or in winter-time in a warm place, and after it has ſtood three or four days, ſet it on aſhes over a charcoal fire, boil it ſoftly for two hours, and when you ſee the ſpirits of a yellow-browniſh colour, and of a thick conſiſtence, pour it hot through a hair cloth, and preſerve it in a clean phial for uſe.

A White or clear Lac Varniſh.

TAKE gum elemi, gum animæ, white frankincenſe, and white amber, of each one dram, grind them fine, put them into a glaſs, and boil them in diſtill'd vinegar; then pour off the vinegar, and waſh the ſediment with clean warm water, and it will be of a white colour; dry it, and grind it fine again; add to it one dram of gum tragant, two drams of white ſugar-candy, both finely ground, put it by little and little into a matraſs, wherein you have before-hand put two pound of high rectified ſpirits of wine; and after you have put all the ingredients into it, ſhake it for an hour together, then put it into a *Balneum Mariæ*, and when it begins to boil, let it continue ſo for two hours; then let it cool: and after it is cold let it ſtand for three days, decant it off into a clean phial, ſtop it cloſe, and it is then fit for uſe. *Or,*

TAKE the above ſpecified ingredients, boil them in vinegar as directed, and after you have put to it the gum tragant and ſugar-candy, take of clear oil of ſpike or turpentine one pound, cyprian turpentine ſix ounces, put them together into a ſtrong matreſs, and ſet it, furniſhed with a leaden ring, in a bath heat; when that heat begins to boil, and the turpentine is diſſolv'd, then add the other ingredients finely ground to it; ſtir them well together with a wooden ſpatula, and let them ſtand in the boiling balneum for three or four hours; then take it out, and when cold, and has ſtood two or three days, pour it into a clean phial, and you will have a fine varniſh.

A fine Varniſh for Blue and other Colours, which will make them bright like Looking-Glaſs.

IF your table is to be of a blue colour, then paint it firſt over with indigo and white, ground with oil, and a little turpentine; when dry, you may give it another layer, and heighten or deepen it to your liking, and when this is thoroughly dry, then varniſh it with the following varniſh:

Take clear cyprian turpentine half an ounce, ſandarac one ounce, maſtic two ounces; grind the ſandarac and maſtic very fine; then take oil of ſpike two ounces, oil of turpentine one ounce, put it into a glaſs cucurbit, and diſſolve it over a gentle heat; add to it the pulverized gum, ſet the glaſs or matraſs in a pan with water; and let it boil over a ſlow fire for an hour, and all will be diſſolv'd and united; then let it cool, preſerve it in a phial well ſtopp'd for uſe.

When you uſe it, firſt wipe your painted table, and clean it from duſt, then take ſome fine and light ſmalt in a cup, or upon a plate, according to what quantity your piece requires, temper it with the above varniſh, and with a large hair bruſh pencil glaze it as quick as you can all over; let it dry in a clean place that is free from duſt, which will be in about three hours time, then glaze it over again; the oftner you repeat it, the brighter will be your table; and if you will have it of an exceeding fine luſtre, glaze it over 12 or 15 times

A Chineſe Varniſh for all ſorts of Colours.

PUT into a matraſs a pint of ſpirits of wine, one ounce of gum animæ, two ounces of maſtick, two ounces of ſandarac or juniper gum, powdered finely together in a mortar: then put them together into the matraſs, cloſe it up, and hang it in hot weather in the ſun for 24 hours, or ſo long over a fire, till the gum is diſſolv'd, and the ſpirits are tinctur'd therewith; then filtre it through a clean cloth, and keep it in a phial clos'd up; you may mix therewith what colour you pleaſe: for red uſe vermillion, for black uſe lampblack or ivory black, for blue uſe indigo and white, *Pruſſian* blue or ſmalt and white lead, *&c.*

How to Varniſh Chairs, Tables, and other Furniture; to imitate Tortoiſe-Shell; ſo as not to be defac'd by Oil or Spirituous Liquors.

FIRST lay your work over with a lac varniſh, as you have been inſtructed above; then lay it over again with red lead and yellow pink, well ground and mix'd up with the ſaid lac-varniſh; you may do it twice or three times over, letting it dry throroughly every time before you repeat: after which rub it with *Dutch* ruſhes, ſuch as the joiners and cabinet makers uſe.

Then take dragons-blood, which is a red gum, and may be had at any druggiſts, beat it very fine in a mortar and temper it with this varniſh: if you would be very nice, ſtrain it thro' a fine hair cloth, and put it up in a phial for uſe; the longer it ſtands the finer the colour will be: with this you may ſhade over your table or other work in the beſt manner you can: if you over cloud it again, you muſt have a darker ſhade: and to deepen your ſhades, you may add to your varniſh a little ivory black, umber or indigo, and work the colours together according to the beſt of your judgment. When you have done your work, and it is thoroughly dry, then take ſome pumice ſtone, make it red hot, and beat it to a fine powder, and with this and *Dutch* ruſhes, ſoak'd in water, rub it ſmooth, and afterwards with a clean woolen rag; and holding it over a gentle heat, give it five or ſix more coats of varniſh, but be careful it be not heated too much, leaſt it ſhould bliſter, and ſpoil your work; after it is thoroughly dry, then take tin-aſhes and ſweet oil, and with the rough ſide of *Spaniſh* leather poliſh it, and give it the finiſhing ſtroke with ſome tin aſhes and the palm of your hand, wiping it till it has gained a fine luſtre.

From this direction the artiſt will make further improvements.

A very fine Indian Varniſh.

TAKE four or five quarts of good ſpirits, diſtill and rectify it to the higheſt degree, that when you light a ſpoonful, it will conſume in flames, and leave nothing behind. Having this ready, take gum-lacca, beat it fine, and put it to the ſpirit into a phial or matraſs; let the ſpirit be four fingers high above the gum, cloſe the glaſs, by tying a treble bladder over it, then put it on a hot ſand, and let it ſtand till the ſpirit and gum is well united and boil'd; but be careful to ſee whether you perceive any bubbles riſe to the top of the glaſs, and as ſoon as you perceive them, take a needle and prick the bladder, in order to give it vent, elſe your glaſs will be in danger of burſting.

After which filtre it thro' a filtring paper into another glaſs, and keep it cloſe ſtopp'd for uſe.

If you would uſe this varniſh with colours, let them be firſt ground with the rectified ſpirits, and then temper as much as you have occaſion for preſent uſe with the varniſh, and lay it on your work; and when you think you have laid your varniſh thick enough, poliſh it, when dry, with *Dutch* ruſhes; then give it a ſecond poliſh with tripoli and ſweet oil; afterwards give it another layer or two of clear varniſh, and it will be fine and anſwer the purpoſe.

To Japan with Gold, Glaſs, or any other Metallic Spangles.

FIRST lay on your work with lac-varniſh; then grind *Cologne* earth and gamboge with the ſame; this varniſh muſt be bright and clear: with that colour lay your work once or twice over; let it dry, and then varniſh it over, and ſift on the gold-duſt, or whatever elſe you deſign it for. If your work or table is large, lay the varniſh on one place after another; for the varniſh will dry in one part before you have done ſifting the other. After you have ſifted your work all over, and it is thoroughly dry, then give it twelve or fifteen lays more of clear varniſh, after which ſmooth and poliſh it as directed.

A very fine Varniſh for a Violin.

TO do this in the beſt manner, you muſt have three glaſſes before you: in the firſt put of the fineſt gum lacca eight ounces, ſandarac three or four ounces, both very finely pulveriz'd; upon this pour of the beſt rectified ſpirit of wine, ſo much 'till it ſtand four inches above the ingredients; when diſſolv'd, ſtrain it through a cloth, and place it cloſed up in a ſtill place to ſettle; in a few days the top will be clear, which you are to decant off in another glaſs, and preſerve it from duſt.

In the ſecond glaſs put of dragon's blood five ounces, and of red wood three ounces, make a ſolution and extract of them with the ſame ſpirit of wine.

In the third glaſs diſſolve of *Colophony* three ounces, *Aloes Succotrines* two ounces, *Orlenium* three ounces; and when the whole is extracted, then pour the ingredients of the three glaſſes into one, ſtop them up, and let them ſettle; then pour off what is clear at top, and filtre the reſt thorough a brown paper. If you find the varniſh too thin, exhale it a little over a gentle heat, and you will have a fine red varniſh, which will gild pewter, and be of an excellent compoſition for varniſhing of violins, *&c.*

A choice varniſh which cannot be hurt by wet.

TAKE gum capall, as much as you pleaſe, beat it fine, put it into a glaſs, and pour of high rectified ſpirit of wine over it four inches high; then cloſe the glaſs with a bladder, ſet it for twenty four hours in a warm oven for the gum to diſſolve, after which put the glaſs in *Baln. Mar.* 'till the ſpirits and the gum are incorporated.

A good Varniſh for Paintings.

BEAT the white of an egg, after you have diſſolv'd a piece of white ſugar candy, about the bigneſs of a filbert, and half a tea ſpoonful of brandy, 'till it becomes a froth; then let it ſettle for a little while, and with the clear liquid varniſh over your picture; it is better than any other varniſh, ſince it may be eaſily waſh'd off again when the picture wants cleaning, and be done afreſh.

A fine Marbling on Wood, or Japanning.

TAKE of the beſt tranſparent yellow amber what quantity you pleaſe, beat it to a powder, put it in a clean crucible which is glaz'd within, let it melt over a gentle charcoal fire, and ſtir it well, to keep it from burning; then pour it upon a ſmooth clean marble table, let it cool, and beat it again to powder. Take afterwards clear turpentine, and in a glaſs warm it in a ſand heat, put into it the beaten amber, let them boil and diſſolve gently together, till they are of a conſiſtence fit to be uſed with a pencil, ſtrain them through a cloth, and you will have the fineſt lac varniſh poſſible; and although it be of a browniſh colour, yet when laid on, it has a fine clear gloſs.

The colours wherewith you are to marble, are the following; lamp-black, brown-red, oker, vermillion; theſe four are ground with linſeed oil: *Venice* white lead is ground with oil of almonds.

For a white, lay your firſt ground with linſeed oil, and if there are any holes in the wood, fill them up with chalk, tempered with ſize. For a black ground lay it firſt with lamp-black and ſize; when the ground is dry, mix the vermillion with the above deſcribed lac varniſh, and with a bruſh pencil lay it on with an even and quick hand; repeat this three or four times till it is bright and fine, and lay the varniſh by itſelf over it twice or thrice: then mix your other colours with the varniſh in an oiſter-ſhell, or in little cups, and with them marble upon the ground you have prepared, in imitation of any thing you deſign.

A fine Gold Varniſh, wherewith you may gild ſilver'd or tinn'd Things with ſuch Luſtre as if done with Gold.

TAKE of the fineſt gum lacca, in grains, eight ounces; clear gum ſandarac two ounces, dragon's blood one ounce and a half, colophoni or black roſin one ounce and a half, beat all together into powder, and put it into a quart of high rectified ſpirit of wine, which is ſtrong enough to fire gun-powder; put it in a ſand heat over a ſmallcoal fire, let it boil for two hours (if you do it in *Baln. Mar.* it is better) or ſo long 'till it is diſſolv'd as much as poſſible, then let it cool; ſtrain it thro' a cloth into a glaſs, ſo as to ſeparate the droſs that might have been in the ingredients: this you are to lay on every thing that has been ſilvered or tinn'd, three or four times, and it will reſemble the brighteſt gold. If you would have the gold colour ſtill higher, you only add about two grains of gurgummi, two grains of the beſt hepatic aloes, and one grain of the fineſt dragon's blood, boiling them up, and ſtraining them thro' a cloth into another glaſs.

When you would uſe it, put the glaſs into a baſon with water over a gentle charcoal fire, in order to make the varniſh fluid; it is alſo requiſite to warm the work before you begin to varniſh it.

OF CORAL WORK.

To make Red Coral Branches, for the Embelliſhment of Grottos.

TAKE clear roſin, diſſolve it in a braſs pan; to one ounce thereof add two drams of the fineſt vermillion; when you have ſtirr'd them well together, and have choſe your twigs and brances, peel'd and dry'd, take a pencil and paint theſe twigs all over, whilſt the compoſition is warm, and ſhape them in imitation of natural coral of a black thorn; when done, hold it over a gentle coal fire; turn the branch with your hand about, and it will make it all over ſmooth and even, as if poliſh'd.

In the ſame manner you may with white lead prepare white, and with lampblack, black coral.

A gentleman may with a very little expence build a grotto of glaſs cinders, which may be eaſily had, pebbles or pieces of large flint, and embelliſh it with ſuch counterfeit coral, pieces of looking-glaſs, oiſter, muſſel, and ſnail-ſhells, moſs, pieces of chalk, oar, *&c.* As to the cement to bind and cement them together, you have directions how to prepare it under the article of cements.

PART VI.

The Art of preparing Colours for PAINTERS, LIMNERS, *&c.*

I. *Of* BLUE COLOURS.

To make or prepare Ultramarine.

TAKE of Lazur-ſtone or *Lapis Lazuli* the blue veins, calcine them in a crucible on a charcoal fire, and quench them in vinegar, repeat this twice over; then grind them on a fine hard ſtone to an impalpable powder.

When thus ground take white roſin, pitch, new wax, maſtick and turpentine, of each ſix ounces; frankincenſe and linſeed oil, of each two ounces; let them diſſolve together over a gentle fire; ſtir them well with a wooden ſpatula, in order to unite them together; then pour them into clean water, continually ſtirring them, take them out, and preſerve them from duſt for uſe.

When you deſign to prepare your ultramarine, take to each pound of the pulveriz'd *Lapis Lazuli* 20 ounces of the maſs. The maſs you are to diſſolve before a gentle heat by degrees, in a pipkin, and fling the powder into it by little and little, whilſt it is diſſolving; after your powder is all in, and well incorporated with the maſs, then pour it into a pan with cold water, form it into little tents or drops; but to prevent its ſticking to your fingers, you muſt anoint them with linſeed oil, thoſe tents or drops you are to put again into freſh cold water for 15 days, ſhifting the water every other day.

Then take and put them into a clean earthen well glaz'd cup or baſon, and pour warm water on them; when that is cold, pour it off, and put freſh warm water to it; this you are to repeat till the tents or drops begin to diſſolve, which will then turn the water into a blue colour.

When the water is of a fine blue tincture, and cold, then decant that into another clean earther cup or baſon, and pour more warm water upon the remaining tents; when that alſo it colour'd, decant it off, and pour freſh on, repeating this till the water receives no more tincture.

Let the tinctured waters ſtand for 24 hours to ſettle, after which you will obſerve a greaſineſs on the ſurface; which, together with the water, your are to pour off gently, and put freſh clean water upon the ſediment, ſtirring it well together, and ſtraining it thro' a fine hair ſieve into a clean bowl; the ſieve will attract ſome of the ſlimy or greaſy matter, that might otherwiſe remain therein; and after you have waſh'd your ſieve, and repeated the ſame thing with the next ſediment, ſtraining it through with clear water, three times ſucceſſively, then let it ſettle; pour off the water and let it dry of itſelf. Thus you will have a fine ultramarine.

To prepare a curious Blue Colour, little inferior to Ultramarine, from Blue Smalt.

GRIND your ſmalt ver fine, and proceed in every reſpect as you have been taught above, in preparing ultramarine.

To prepare a curious Blue Colour from Silver.

HAmmer ſilver thin, neal it thoroughly, and quicken or anoint it a little over with quickſilver; then put a little of the ſharpeſt diſtill'd vinegar, in which you have diſſolv'd ſome ſal-armoniac, into a glaſs; hang the ſilver ſlips over it, ſo as not to touch the vinegar: cover it very cloſe, and put it into a warm place, ſo that thereby the fumes of the vinegar may be raiſed a little, theſe extract out of the ſilver a very beautiful ultramarine, which adheres to the ſilver ſlips; wipe them off into a ſhell, and hang the ſilver ſlips over the vinegar again, well cloſed; repeat this till all the tincture is extracted from the ſilver.

Another Method.

TAKE of the fineſt ſilver, what quantity you pleaſe, and diſſolve it in a clear and ſtrong ſpirit of nitre; then draw off half of the ſpirit of nitre, and ſet the glaſs in a damp and cool place, and the ſilver will over night ſhoot into fine cryſtals, not unlike ſaltpetre; then decant the ſpirit of nitre clear from it, put the cryſtals into glaſs plates, and let them ſtand in a warm place till they run into a flour; then grind them with as much clear ſal-armoniac, ſubiim'd over common ſalt, ſet them together in the open air, till you ſee the maſs become of a blue or greeniſh hue; then put them together into a cucurbit with a large head to it, and ſublime them, and the ſal armoniac will carry the *Anim. Lun.* up along with it: after this grind the ſilver that's left at the bottom of the matraſs with freſh ſal-armoniac, and ſublime it as before; this repeat till all the *Animæ*, or the fine blue tincture, is extracted from the ſilver; evaporate the water over a gentle fire, and you will recover your ſal-armoniac again; the tincture you are to dry and preſerve. It is a fine and beautiful colour, fit to be uſed for the moſt curious painting or limning.

Another Method.

TAKE of the fineſt ſilver as much as you will, beat it very thin, and with four times as much quickſilver make it into an amalgama, ſtrain it through a leather, and drive all the mercury afterwards from it; thus you will have a fine ſilver calx, which diſſolve in clear aqua fortis, the quantity whereof muſt be as little as poſſible; when it is diſſolved, let the water evaporate, and the ſilver will remain at the bottom like moiſt aſhes; pour over it ſome ſal-armoniac mixed with ſharp white wine vinegar, let it ſettle and turn clear; then pour off the vinegar, and keep the ſediment at the bottom for a month, well cloſed up, to prevent the leaſt evaporation, and you will find a very curious blue colour.

To prepare a Blue Colour from Verdegreaſe.

TAKE ſal-armoniac and verdegreaſe, of each ſix ounces; mix them well together with water of tartar, into a paſte, put this into a phial, and ſtop it cloſe; let it ſtand for ſeveral days, and you will have a fine blue colour.

Another Method.

TAKE ſal-armoniac one part, verdegreaſe two parts, beat them both to a powder, and mix them with a little white lead; then incorporate them together with oil of tartar, put them into a glaſs, and cloſe it well; put it afterwards in a loaf, and bake it in a baker's oven; as ſoon as the loaf is baked enough, your colour will be ready. *Or,*

TAKE quickſilver two parts, ſulphur three parts, ſal armoniac four parts, mix and beat all well together, temper them with water, put them in a well glaz'd pipkin into a furnace, over a coal fire, and when you ſee a blue ſmoak ariſe, take it off and let it cool, then brake the utenſil, and you will find a fine sky blue, not unlike ultramarine.

To prepare Blue Torniſel, *a beautiful Colour.*

TAKE ſloes, before they are full ripe, beat them into a paſte, and put it in a clean earthen pan; take another earthen pan, put into it a quart of water, 3 *oz.* of quick-lime and ¼ *oz.* of verdegreeſe, and 1 quintal ſal-armoniac; let theſe things ſoak ſo long in the water till it is tinctur'd of a green colour. In 24 hours the lime and verdegreaſe will be ſunk to the bottom, then diſcant off the water through a cloath, into another earthen veſſel, add to it the paſte of ſloes, and let it gently boil over a ſlow fire; when cold it will be of a fine sky blue; then pour that liquid into a clean pan through a cloth, ſet it on hot aſhes, and when it begins to be of a thickiſh ſubſtance, then put it up in a bladder, and hang it up to dry. You may alſo dip clean ſoft linnen rags into it, dry them in the ſhady air; when dry, repeat it again for 3 or 4 times; theſe preſerve in paper, and when you have occaſion to uſe it, ſoak one of theſe rags in a little fair water, and you will have a beautiful blue colour.

A Blue of Egg ſhells.

TAKE egg-ſhells, calcine them in a crucible; beat them to a fine powder; put that into a copper box, and pour vinegar over it; which ſet into horſe dung for a month, and and you will have a delightful blue.

To make Venice *Sky Blue.*

TAKE quick-lime one pound, mix and work it with ſharp white wine vinegar into a dough; let it ſtand for half an hour, and when hard, pour more vinegar to it, in order to make it ſoft; when done, add to it two ounces of pulverized fine indigo, mix it firſt well together, ſet it into a glaſs veſſel for 20 days under horſe dung, after which time ſee whether it is of a fine colour; if not, ſet it again as long as before in the dung, and it will then come to its perfection.

II. Of ſeveral RED COLOURS.

To make fine Lac from Cochineal.

TAKE cochineal eight ounces, alum one pound, fine and clean wool eight pound, fine powdered tartar half a pound, bran of rye eight handfuls; boil the bran in about three gallons of water, more or leſs, it is no great matter; put it over night to ſettle, and pour it through a flannel to have it clear and fine; then take a copper kettle, large enough to contain the wool; pour half of the bran water and half clean water to it, ſo much as you think ſufficient to boil the wool in; let it boil, then add the above tartar and allum to it, and put in the wool, let it alſo boil for two hours, turning all the while the wool up and down, in order to cleanſe it thoroughly: after it has boiled that time, put the wool into a net, to drain out the water: take then the other half of the bran water, and add to it as much clean water, and let it boil; after it is well boiled put in cochineal, which muſt be previouſly ground very fine ſne with four ounces of white tartar; you muſt ſtir it continually about, whilſt it is boiling, to prevent its running over, then put in the wool, and let it boil for an hour and a half, keeping it all the while turning about; after the wool has attracted the colour, put it again into a net, let the water drain off, and you will have it of a ſcarlet colour.

This colour may indeed be done in another manner, and of a brighter luſtre, in a pewter kettle, with tin and aqua-fortis, but the above method is ſufficient for the purpoſe deſigned, and may be made by any body, without the implements which are required to dye it the other way.

To extract the Lac from the Scarlet Wool.

TAKE clean water about ſix or ſeven gallons, diſſolve therein as much pot aſhes as will make it a good ſharp lee, filtrate it through a felt or flannel bag to make it very clear; in this put the wool, let it boil well in a kettle, till it is white again, and the lee has extracted all the colour; then pour it again through a clean felt or bag, and ſqueeze out the wool; then take two pound of allum, let it diſſolve in water and pour it in the coloured lee; ſtir it well together, and it will curdle and turn of a thick conſiſtence like a paſte; pour it again into a clean bag, and the lac will remain in the bag, but the lee will run clear from it; and in caſe it ſhould ſtill run coloured from it, you muſt let it boil with a little of the diſſolved allum, which will wholly curdle it, and keep the lac black.

When the lac is in this manner in the bag, pour clear water over it, in order to clear it from the allum or ſalt that may ſtill remain in it, and take a plate of plaiſter of paris, or chalk, ſtrain the lac through a paper cone that has a ſmall opening at the point, in little drops or tents upon it, and when dry, put them up for uſe.

You muſt obſerve, that in caſe the liquor ſhould fall ſhort in boiling the wool, you muſt recruit it, not with cold, but with warm water.

If you can get the parings of ſcarlet cloth, you will ſave yourſelf much trouble, by only boiling them in the lee, and proceeding as has been directed. *Or,* TAKE lee of aſhes or tartar, to this put a little diſſolv'd allum, and pour it into a wide glaſs veſſel; then take cochineal, put it into a cloſe linnen bag. and ſwing it backwards and forwards in the lee, till all the colour is extracted; then take lukewarm allum water- pour as much upon the lee as will curdle it; pour the curdled lee through a flannel, ſweeten it with clear water, then dry the colour on a piece of plaiſter of paris, as before directed.

To make fine Vermillion.

TAKE two parts of quickſilver, and one third of ſulphur, put it into a pipkin, and melt the ſulphur and the quickſilver together; when it is cold, then grind it well upon a ſtone, and put it into a glaſs, which beforehand has been laid over with a coat an inch thick; then make a coffin of clay for the glaſs to ſtand in, ſet this on a trivet, firſt over a ſlow fire; put a cover of tin, with a little hole in the middle upon the glaſs, and lute it all round: put an iron wire through the hole, for to ſtir it about, augment your fire by degrees, and watch your glaſs carefully; for you will ſee a coloured ſmoak proceed from the matter in the glaſs, but keep on augmenting your fire, till you ſee the ſmoak become of a red crimſon colour, then it is enough; take it off the fire, let it cool, and you will have a fine vermillion.

Before you uſe it to paint or write therewith, take as much vermillion as you will, and grind it well with good white-wine on a ſtone, and after that with the white of eggs, add a little hepatic aloes to it; make it up in little cakes, and when dry, put them by for uſe. When you uſe them, grind or dilute them with clear pump water, and a little white of eggs; and if it will not flow readily from the pen, mix a little myrrh with it.

How to purify Vermillion.

THE vermillion being made of mercury and ſulphur the impurities which it has contracted from thoſe minerals muſt be ſeparated, and this is done in the following manner.

Grind the pieces of vermillion with water upon a ſtone, and put them on glaz'd plates to dry; then pour urin upon them, and mix them thoroughly with it, ſo that it may ſwim over it, let it thus ſtand, and when the vermillion is ſettled, pour off that urine, and put freſh upon it; let it ſtand all night, repeat this for four or five days ſucceſſively, till the vermillion is well cleanſed; then pour the white of eggs over it, mix it up therewith, and ſtir it well together with a ſpatula of hazel; let it ſtand again, when ſettled pour it off, and put freſh on; repeat this three or four times, covering your veſſel every time cloſe, to keep the duſt from falling into it, which elſe would diminiſh the beauty of the colour: when you would uſe this vermillion, dilute it with gum-water. *Or*,

GRIND the vermillion with the urine of a child, or ſpirits of wine, and ſet it to dry in the ſun.

If you would have the vermillion of a high colour and free from its black hue, then put into the ſpirits or urine a little ſaffron, and grind your vermillion with it.

To make a fine Purple Colour.

MELT one pound of tin, after which put two ounces of quickſilver to it; ſtir it ſo long together, till it is an amalgama; then take ſulphur and ſal armoniac, of each one pound, grind it fine, and mix it up with the amalgama, in a ſtone mortar, or wooden bowl; put it into a glaſs, which is well coated with clay, ſet it firſt over a gentle fire, and augment it by degrees, ſo as to keep it in one uniform motion; ſtir the matter with a ſtick, and when you perceive it to be of a yellow colour, take it off the fire, and let it cool, and you will have a fine gold colour, beſides a beautiful purple.

III. Of all Sorts of COLOURS extracted from Flowers, *&c.*

How to extract a Yellow, Blue, Violet, and other Colours.

PREPARE a middling ſharp lee from lime, or pot aſhes; in this boil the flowers or leaves of ſingle colours, over a ſlow fire, ſo long till the tincture of the flower is quite extracted, which you may know when the leaves turn pale, and the lee is of a fine colour. This lee put afterwards into a glazed pipkin or pan, and boil it a little putting in ſome roach allum; then pour the lees off into a pan with clean water, and you will ſee the colour precipitate to the bottom; let it ſettle well, then pour that water off, and add freſh; repeat this till the tincture is entirely cleanſed from the lee and allum; and the freer it is therefrom, the finer will be your colour. The ſediment is a fine lake, which ſpread upon linnen cloth, and lay them on clean tiles in the ſhade to dry.

You may dry your colours upon a plate of plaiſter of paris, or for want of that on a piece of chalk; either of them will do, and dry the colours quicker than the method above.

To the receipt for extracting the tinctures from flowers, leaves, herbs, and plants, by diſtillation, which has been already inſerted p. 151. I only add, that it will be adviſeable to preſerve the firſt droppings of the extraction that fall in the receiver, by themſelves, they yielding the fineſt and moſt beautiful colour. Care muſt be alſo taken, not to bruiſe the tender leaves of the flowers, elſe the coarſe juice will diſtill along with the tincture, and make it of an unpleaſant hue. Such leaves that are firm and ſtrong, require not that care.

Mr. Kunkel's *Method of extracting the Colours from Flowers,* &c.

I Take, ſays he, high rectified ſpirits of wine, and pour it over a herb or flower, which I will; and if the leaves of plants are large and coarſe, I cut them ſmall, but I leave the leaves of flowers whole, as ſoon as I perceive the ſpirits tinctured, and find both colours of an equal tent, I put them together; but if they differ, I ſet each a part by itſelf, after which I diſtill the ſpirits of wine from it to a very little, ſo that I may take it of the cucurbit, and then put it into a china tea ſaucer, a glaſs cup, or a ſmall matraſs, and let it evaporate over a flow fire till it comes to ſome thickneſs, or, if you will, quite dry; but this muſt be done very ſlowly on account of the tenderneſs of the colour.

Some flowers will change their colours and produce quite different ones, and this the blue flowers are moſt ſubject to; to prevent which, one muſt be very ſlow and careful in diſtilling them; I have never had ſo much trouble with any other colour'd flowers as the blue ones, and yet, I cannot boaſt that I have obtain'd a blue colour from flowers to my ſatisfaction. The whole matter depends chiefly upon care; practice will be the beſt inſtructor.

By this method one may plainly ſee what flowers or plants are fit for uſe, for by only infuſing ſome in a little ſpirits of wine, it will ſoon ſhew what colours they will produce.

IV. Of GREEN COLOURS.

How to make good Verdigreaſe.

TAKE ſharp vinegar, as much as you will, clean copper flakes, one pound, ſalt three quarters of a pound, red tartar eight ounces, ſal-armoniac two ounces, leaven twelve ounces; beat what is to be beaten to a fine powder, and mix the whole with the vinegar well together; put it into a new well glaz'd pan, cover it with a lid, and lute it with clay; then bury it for 18 or 20 days in horſe dung. Take it out again, pour off the vinegar gently, and you will have good verdigreaſe.

Another.

TAKE a well glaz'd pan or pot, put into it good ſharp vinegar, then take thin copper filings a pretty large quantity, put them into a crucible, and ſet the ſame into the pan with vinegar ſo that the vinegar may not touch the copper; then lute the cover well with clay to keep out the air; thus put the pan into horſe dung, or into a warm place, for 25 days; then take it out again, open it, and you will find the verdigreaſe hang to the copper filings, ſcrape the verdigreaſe with a knife off the ſaid filings, and let it fall into the vinegar, after which, cloſe up the pan again as you did before, put it into the dung or a warm place, and thus repeat it till the copper is all conſum'd: the verdigreaſe will ſettle at the bottom of the pan, which, after you have gently poured off the vinegar from it, you may put up for uſe.

Another eaſier Method to make Verdigreaſe.

TAKE a copper kettle or bowl, put into it good ſharp vinegar; ſet it in the heat of the ſun to dry, and you will have fine verdigreaſe; after you have taken it out of the kettle or bowl, you may pour more vinegar, and repeat it as often as you think proper.

To make a fine Verdigreaſe for Dyers.

FIRST take four pound of tartar, two pound of ſalt, one pound of copper-aſhes, one pound and a half of good vinegar,then take a crucible or an unglaz'd pan, take a handful of tartar, and fling it into the crucible, alſo one handful of ſalt, and a handful of copper aſhes, fling all in, one after another, till the crucible or pan is full; then pour on the vinegar, and ſtir it well together, till the ingredients are thoroughly moiſt, and are turned of a black colour, cover the pan and lute it cloſe with clay, to prevent the air coming to it, put it for a fornight or three weeks in hot horſe-dung, and you will have a good verdigreaſe. If you would have it dry, hang it up in a bladder in the air. *Or,*

TAKE vinegar in which has been ſteep'd ſome copper, and one pound of ſearc'd ſalt; mix the ſalt with ſo much vinegar as to make it of a conſiſtence; then put it into a copper veſſel, cloſe it up and ſet it in a damp place; and after it has ſtood ſome days, you will have a good verdigreaſe, *Or,*

TAKE an old kettle or copper, and ſcower it it clean with ſand; then take vinegar and honey, of each an equal quantity, mix them together, and ſtrike the mixture all over the inſide of the kettle; then take ſearc'd ſalt, and ſprinkle it upon the honey, ſo as to ſtick to it; have a board, made with a good many holes, and cover the kettle therewith; then turn your kettle with the board upon hot horſe-dung; cover it all over with dung, and let it ſtand for eight days together, and you will have a fine verdigreaſe.

A fine Verdigreaſe for Limners.

TAKE copper ſlips or filings, put them into a ſtrong copper box, with a cover to it; pour ſome vinegar mix'd up with a little honey, into it; ſet it in the ſun, or in a warm place for fourteen days, and the vinegar will become blue; which pour into a glaſs, and cloſe it well up: then put more vinegar and honey upon the copper-filings, and proceed as before, till they do not tincture the vinegar: what you have gather'd up in glaſſes, put in the ſun or a warm place, till it becomes of a proper thickneſs; then grind it on a ſtone, and temper it with a little gum-water: if you would have it of a graſs green, mix it with a little ſap-green.

How to make Sap-Green.

ABOUT a fortnight or three weeks before *Michaelmas*, take as many ſlows as you pleaſe, maſh them a little, and put them into a clean glazed pan; ſprinkle them well over with powdered allum, and let them ſtand in a hot place for 24 hours; and then pour upon them a clear lee, put it upon a fire, and give it a ſlow boiling, till a good quantity is boiled away; then take it off the fire, let it cool, and pour it through a cloth; what comes through, put up in a bladder, and hang it in the air to dry; afterwards keep it always hanging in a dry place, or in the chimney corner; and when you have occaſion to uſe it, take as much as you want and dilute it with clear water; If it ſhould turn too much upon the yellow, mix it with a little indigo.

Another finer Sap Green.

TAKE of blue lillies that part of the leaf which is of a fine blue colour, for the reſt is of no uſe, and ſtamp them well in a ſtone mortar; then put upon them a ſpoonful, or according to the quantity of the leaves, two or more ſpoonfuls of water, wherein before has been diſſolved a little allum and gum arabick, and work it well together in the mortar; then ſtrain it through a cloth, put it into muſſel ſhells, and ſet them in the ſun to dry. *Or*,

AFTER you have proceeded as before, fling ſome powdered quicklime over it, before you ſtrain it thro' a cloth, and put it in muſſel-ſhells. *Or*,

BEAT the blue leaves of lillies in a ſtone mortar, ſtrain them through a fine cloth into muſſel ſhells, and fling ſome powdered allum over it, to one more than the other, in order to make the colour of different ſhades.

To prepare a fine Green Colour.

TEMPER indigo and yellow orpiment with gum-water; grind it fine, and mix with it a little of ox or fiſh-gall, and you will have a pleaſant green. You may ſhade it with indigo or ſap green, and heighten it with *Dutch* pink.

Of WHITE COLOURS.

To make fine White Lead.

TAKE ſome caſt ſheet lead, cut it into plates of about two inches wide, and ſix or eight inches long, make thro' each of them a hole, to draw a ſtring through; then have an oaken veſſel, about two foot high, into this put two quarts of good vinegar, and a veſſel, and cover it; ſet it over a gentle coal fire, and let it be boiling hot; then take it off, and put it for ten days in a warm place; then take off the cover, take out the plates, and they will be covered with a white colour on both ſides, a finger thick, which you are to ſcrape off with a knife, and put into a clean baſon; then hang the plates again in the wooden veſſel, and proceed as before, ſcraping the colour once every ten days: grind the colour in a ſtone mortar with clean water to a paſte, and put it up in clear pans to dry.

Another Method to make White Lead.

TAKE long and flat pieces of lead, hang them in a glaz'd pan, or rather in an earthen ſquare veſſel, pitch'd on the inſide, but before you hang the lead in the veſſel, pour into it good vinegar, heated; cover it cloſe, lute it to keep out the air, and put it in a warm place for a month or five weeks; then take off the cover, and ſcrape off the white lead, which hangs about the lead, this you may repeat every fortnight or three weeks, and you will have good white lead.

To prepare another white Colour.

TAKE quick-lime, mix with it calcined egg-ſhells; grind theſe two ingredients with goat's milk very fine, and it is fit to paint withal.

A good White Colour.

TAKE crown-glaſs, and beat it to an impalpable powder; take alſo fine pulveriz'd ſulphur, mix them together in a pan with a cover to it, lute it cloſe, and put it upon a charcoal fire, ſo as to make the pan red hot all over: when it is thus heated, take it off the fire, and let it cool; then take off the cover, grind the matter upon a ſtone with clear water, and temper it either with oil or gum-water: it will give a good white colour.

A fine white Colour for Painting in Miniature.

TAKE four ounces of good biſmuth, beat it fine; then dilute it in eight ounces of the beſt clarified aqua-fortis, pour the ſolution into a glaſs, and put a little ſalt water to it, and the biſmuth will precipitate to the bottom, in a ſnow white powder; pour off the water, ſweeten the powder well with clean water from the ſharpneſs of the aqua-fortis; then dry it, and keep it carefully from duſt; when you uſe it, dilute it with gum-water.

How to refine White Lead.

TAKE fine white lead, grind it upon a ſtone with white-wine-vinegar, and it will turn black; then take an earthen diſh full of water, waſh your ground white lead well, and let it ſettle; then drain the water gently from it, grind it once more upon a ſtone with vinegar, and waſh it again: repeat this three or four times, and you will have a curious fine white, that is fit for the niceſt work, both in oil and water colours.

How to prepare Egg-Shells, for White:

SOAK the egg-ſhells three or four days in good ſharp vinegar; then waſh them in clear water, dry them in the heat of the ſun, beat them to a fine powder, and grind them on a ſtone.

Of ſeveral BLACK COLOURS.

To burn Lamp-black, in order to make it finer, and of a better Colour.

TAKE a fire-ſhovel, hold it ſo long in the fire till it is red hot; then fling your lamp-black upon it, and when it is done ſmoaking, it is enough.

How to make a finer Lamp-black than what is ordinarily ſold in Colour or Chandler Shops.

HAVE a lamp with a large wick of cotton ſtor'd plentifully with oil; fix over the lamp a ſort of canopy, made of tin or iron; the ſmoak which ſettles to it, ſweep off with a feather, and preſerve it from duſt. When you uſe it, temper it with oil or gum-water.

To

To make a Black of Trotter-Bones.

TAKE as many trotter-bones as you pleaſe, burn them in a clean crucible, and quench them in damp linnen rags; grind them with fair water, before you uſe them with it: this black is fit to be mix'd with lake and umber for ſhades, in carnation or fleſh colour.

To make Ivory Black.

TAKE the ſhavings or raſpings of ivory, which you may eaſily have at the comb-makers: mix them up with a little linſeed oil, put them into a pan or crucible, and lute it cloſe, leaving only a little hole in the middle of the cover; ſet it on a coal fire, and let it ſtand till you perceive no more ſmoak; then take it off, and ſet it in ſand, putting another pan or crucible that is entire over it; when cold, you will have the fineſt black colour that can be prepared.

Another Method to burn Ivory either Black or White.

FILL a crucible with the waſtes of ivory or hartſhorn, lute it well, and put it in a fire, and when the phlegm, ſpirit, oil, and fluid ſalts have left them, they will be of a very fine black colour; but if you keep them longer in the fire, they will turn as white as ſnow.

A Cherry-Stone Black.

FILL a crucible with cherry-ſtones, cover and lute it well; let them firſt dry by degrees, then burn them to a coal; afterwards beat them to powder, and moiſten them with gum-tragant water; form them into little balls, and they are ready to be uſed, either for oil or water colours.

To make Indian Ink.

TAKE dry'd black horſe-beans, burn them to a powder, mix them up with gum arabic water: and bring them to a maſs, which preſs in a mould made for that purpoſe, and let it dry. *Or,* TAKE one ounce of lamp-black, two ounces of indigo, half an ounce of fiſh-black, grind them with half water and half milk, and a little gum arabic, and form tables thereof. The lamp-black muſt be clear'd from all greaſineſs, by burning it in a clean pan; on a coal fire.

To make a fine Ink-Powder to write or draw with.

TAKE half an ounce of lamp-black, plumb or cherry-ſtones, vitriol and gall-nutts of each half an ounce; burn it firſt together in a crucible; add half an ounce of gum-arabick: all which beat in a mortar to a fine powder, and ſearce it through a fine ſearcer, then put it up in a box, and when you want to uſe it, dilute it with fair water.

To prepare dry Colours or Croions.

FOR *Croions* you make uſe chiefly of earth or mineral-colours, which you grind with milk into a paſte, and then form it into paſtils of what ſize you pleaſe, and let them dry in the ſhade.

Some break the colours with incorporating them with plaſter of paris, with which they bring them to the ſeveral lights or ſhades they require.

Others inſtead of plaſter of paris uſe tobacco-pipe-clay, and when dried, the artiſt makes uſe of blue paper paſted on a linnen cloth that's ſtreach'd in a frame, and works them one in another with a blunt pencil bruſh, or a roll'd up blue paper.

Several Methods of GILDING.

A particular Way of Gilding for ſuch Painters or Gilders as are obliged to perform it in the open Air, where the Leaf Gold cannot be manag'd, on Account of the Wind.

TAKE thin pewter leaves, ſtrike them over with a gold ground, or gold ſize, and when you are oblig'd to gild any thing that is high, and you have no ſhelter to keep off the wind, lay only ſize on your work ſomething ſtronger, in order to make the pewter gilded leaves ſtick on the better.

How to gild upon Wood, Picture Frames, or any other ſort of Work.

THE wood muſt be firſt well ſmooth'd, then twice or thrice ſtruck over with ſize made of the ſhreds of glove leather, and ground nine or ten times over with chalk; when it is dry, rub it well over with *Dutch* ruſhes, to make it even and ſmooth, then with a ſoft hair pencil lay it over with ſize water; after which lay on the gold colour'd ground, twice or three times; when it is thorough dry, rub it over with a linnen rag, till it looks poliſh'd: then have your leaf gold ready cut upon a leather cuſhion, and when with a large pencil, dipp'd in the ſtrongeſt brandy you can get, you have gone over your work, be nimble in laying on the gold: when it is quite dry poliſh it with a tooth.

How to prepare the Size for the Uſe juſt now mentioned.

TAKE two pounds of cuttings or ſhreds of white glove leather, let them ſoak for ſome time in fair water, and then boil them in a pot with ten quarts of water, let them boil to two or three quarts, then ſtrain them through a cloth into a clean earthen pan: you may try whether the ſize be ſtrong enough, by taking a little between your fingers, to ſee whether it is of a glueiſh conſiſtence, and whether it will ſtick.

To prepare the white Chalk.

WHEN you have made the ſize, then take white chalk, ſcrape it fine with a knife, or grind it upon a ſtone; and when you have diſſolved your ſize over the fire, and it is made hot, put in ſo much chalk as will make it of the conſiſtence of a thick paſte; keeping it ſtanding for a quarter of an hour, and then ſtir it well about with a hard bruſh pencil: add to this white colour ſome more ſize, and after you have mixed it well and brought it to proper temper, lay it on the wood which you deſign to gild, by dawbing it all over with a broad pencil, and when you have done, let it dry thoroughly, before you lay onanother ground. This you muſt repeat ten or twelve times.

When you have done laying on your gold ground, then with a ſoft broad hair pencil, moiſtened with clear water, run it all over, in order to ſmooth your ground, and when dry, rub it over with *Dutch* ruſhes, or a piece of new linnen, ſmooth and fine.

How to brunze or metallize Images of Plaiſter of Paris.

TAKE iſinglaſs, ſteep it in very ſtrong brandy, put it well cloſed in a warm place, and it will diſſolve; add to it a little ſaffron, and mix it up with metallic powder in a muſſel or oyſter ſhell, this ſtrike over your image with a ſoft hair pencil; but before you do this, you muſt waſh it over with ſize water, mix'd with a little red lead.

How to prepare the Norimberg *metallic Powder of mixed Colours, which gives a beautiful Luſtre when ſtrewed upon Writing or Letters.*

TAKE the filings of copper, braſs, iron, ſteel, or any other metal, ſearce them through a fine ſieve, and put them into a clean baſon or ſuch like veſſel, waſh them well with a clean and ſharp lee, and when you have poured that off waſh them with clean water, ſo long till you have cleanſed it from all its ſoil.

After your filings are thus cleanſed and dry, then take a ſmooth plate, either of iron or copper, lay it upon live coals, and put one ſort of the filings upon the plate, ſtirring it continually about with an iron ſpatula; as ſoon as the metal is touched with the heat, it changes into variety of colours, and that which ſuffers the greateſt heat, will contract the darkeſt colour, each metal a different ſort.

When thus you have done one ſort, proceed in the ſame manner with another, by which means you will have variety of colours.

Then take a platting mill, ſuch as the ſilver wire drawers uſe, or thoſe employed in platting of gold, ſilver or copper plate, which muſt be fitted with a ſort of funnel at top, thro' which the filings may be conveyed to the platting rolls, which ought to be very exact and parallel to each other, made of the fineſt ſteel, and poliſhed like a looking-glaſs. When you are thus prepared, work it with carefulneſs between the rolls, and you will have a moſt beautiful powder, which ſparkles with all manner of colours.

The filings of braſs produce a bright gold colour; the copper a fine red fire colour; iron and ſteel all manner of ſhades of blue; pewter, marcaſit, and biſmuth, produce a white colour.

To ſpot a white Horſe with black Spots.

TAKE litharge three ounces, quicklime ſix ounces; beat them fine and mix them together; put the mixture into a pan, and pour a ſharp lee over it; then boil it, and you will have a fat ſubſtance ſwim at top, with which anoint the horſe in ſuch places as you deſign to have black, and it will turn of that colour immediately,

It has the ſame effect in changing hair that's red into a black colour, with only this difference, *viz.* You are to take an equal quantity of lime and litharge, and inſtead of boiling it with lee, boil it only with freſh water; what ſwims at top, is fit for uſe, and will anſwer your expectation; what hairs you anoint with it in the evening, will be black the next morning.

How to Dapple a Horſe.

TAKE in the ſpring the large buds of young oak-trees, mix them among the horſe's provender, and give it him three or four times to eat, and he will be dappled, and continue ſo for a whole year; the buds of young elm-trees will have the ſame effect.

PART

PART VII.

Of the Nature and Growth of SALTPETRE.

THE Earth being naturally inclined for the generation of ſaltpetre, there is no occaſion to aſcribe the growth thereof to the urine and excrements of certain animals; for this may be plainly ſeen in ſome particular vegetables, as wormwood, *&c.* which although it grows in ſuch places, where there has been no ſuch excrement or urine, when the juice thereof is preſſed out, will of itſelf ſhoot into ſaltpetre, as is often experienced by apothecaries and chymiſts. However, it muſt not be denied, that urine and excrements, particularly that of ſheep, contribute not a little to the growth thereof.

Saltpetre is of ſuch an increaſing nature, that whatever place is once impregnated therewith, its ferments are multiplied to admiration; and like to a little acid or bitter, will diffuſe its qualities among a large quantity: whoever conſiders this, will eaſily conjecture how to aſſiſt nature in the growth of ſaltpetre. Even ocular demonſtration will prove this; for if one only take a ſilver calx, that is taken out of aqua-fortis, and put it into a glazed earthen plate, and therein ſweeten it with clear water, one will find that the ſmall quantity of ſpirit of nitre which remained in the calx, and is drawn from it by waſhing it in clear water, impregnates the earthen plate in ſuch a manner, that although the moſt remains in the water, yet it ferments in ſuch a manner, that in a little time, it grows all over and out of the plate, and cauſes the glazing to ſcale and fall off.

We know, that when aqua-fortis is diſtilled from common ſalt, the dregs thereof will turn into good burning ſaltpetre; and more ſo, if for example you diſſolve common ſalt in aqua fortis or ſpirit of nitre, warm, and ſet it afterwards to ſtand in the cold, it will ſhoot in ſaltpetre. From which fundamental expreriments one might try a fermentation, whereby ſalt petre might be in greater quantity generated, as indeed ſome, not without good ſucceſs, have made attempts that way, and that in different methods. Some have aſſiſted the ſaltpetre earth, after it has been boiled out, with trifling means, that in a ſhort time the earth has grown rich therein again, which was, by mixing the earth, when laid up again, with the skimming of what was boiled out.

Others dig one or more large pits in the earth, and with the earth flung up, wall it round for to prevent floods of rain running into it; for which reaſon they cover it alſo with a roof, to keep it from rain, but leave it open to receive the ſun beams and the air. In ſuch holes they fling all their ſweepings, aſhes of which lee has been made, as well as others that ſeem uſeleſs, the remains or aſhes of burnt ſtraw, ſoot of chimneys, the ſweepings of poultries, pidgeon-houſes, all ſorts of bitter and ſharp vegetables, as wormwood, wolfs-milx, nettle, fleegraſs, ſea-bands, the fallen fruit in autumn, or rotten fruit, the excrements of men and beaſts, and any dung, the outcaſts or garbage from ſlaughter-houſes, as hair, claws, horns, the paunch with dung, guts and blood, all manner of urine, ſuds that have been uſed in waſhing, and the like, till the pit is full; where let it rot for ſome years, daily flinging upon it urine, brine of herrings or meat, add ſuch like, till it is rotton; then they ceaſe from flinging any moiſture upon it, and let it lie dry till they boil the ſaltpetre out of it: then they fling what remains again into the pit, pouring upon it the liquor that will not ſhoot, and ſo let it lie a conſiderable time before they boil it again.

Others have built particular long vaults underground, about three yards deep, covered with boards or with a roof of pantiles. The mortar for it is prepared of three parts lime, ſlackened with rain water, which has fell with a north wind, ſheep's urine one part, ſheep's dung three parts, all well beat together, and mix'd with common ſalt; with this the vault is built up two bricks thick, then covered with old ſtable dung; every fortnight, in the increaſe of the moon, it is watered all over with north wind rain water, and ſheep's urine; and the ſaltpetre will ſhoot out in the vault into cryſtals.

Another method for the ſpeedy growth and increaſe of ſaltpetre is, by building a ſhed of deal boards, as large as one pleaſes or has conveniency for; but if poſſible, in a place, where it may lie open to the four winds; the roof is either boarded or thatched, but the four ſides are left open: under this ſhed a layer of earth is laid, about a foot high, in four different heaps; then is poured over a brine of ſalt lime, mixt with the urin of men and beaſts; over this is laid another layer of earth, and proceed as directed before, repeating it till the ſhed is near full, and working each heap gradually tapering up in the form of a roof, ſo that the wind may the eaſier penetrate into each heat; then laying a coat of earth over it, the ſalt and other liquids are pour'd over it again: after theſe four heaps have ſtood a month, they are, every third or fourth day after the new moon, rak'd up with an iron rake, about a foot deep, and moiſtened with urine and ſaltpetre water, or dunglee, which is pour'd upon them out of a watering pot. After theſe heaps, thus prepared, have ſtood about four months, they will be twice as rich in ſaltpetre, as common ſaltpetre earth, and may be boiled out every quarter of a year: The earth when boiled out is laid up again under the ſhed, and work'd up as before; and whilſt the laſt heap is boiling out, the firſt is in its bloom again, and encreaſes in richneſs more and more, ſo that after a few boilings, it may be boiled out every month. The conveniency, diſpatch and profitableneſs of this ſaltpetre work will require to have the boiling houſe in the middle of the four or more heaps: but then the roof of the ſhed ſhould not be thatched, for fear of an accident by fire; there may (if the ſhed be filled with large heaps) four coppers be fix'd in the boiling houſe, and ſo contrived that one fire may ſerve them all.

I ſhall here preſent the reader with a ſcheme for a ſaltpetre garden, which was formed by *Cordil*, and uſe his own direction, which is thus:

Build a vault about 60 or 80 yards in length, or according to what room you have to ſpare, four yards high, and eight broad, on a firm ground; let there be two doors, the one towards the north and the other towards the ſouth, and dreſs the top of this vault like a garden; at one end whereof have a little houſe for a labourer to live in, who is to look after the ſaltpetre work, and water the garden every ſecond or third day, in the encreaſe of the moon; he muſt ſave beforehand the water of a ſouth or north wind rain, which is beſt, and mix it with urine of men, horſes, oxen, cows, ſheep, *&c.* flinging into it ſeveral handfuls of common ſalt, and ſtirring it well together: in the winter ſeaſon, when there is hard froſt and ſnow, the vault muſt be ſheltered with boards, and a little charcoal fire kept in it, leaving both doors open; but this is only to be obſerved in very hard winters. When the vault is thus finiſhed and attended, the owner thereof will in ſix or nine months time find the ſaltpetre ſhoot out in great quantities, and the ofther the cryſtals are broken off, and the garden nouriſhed by watering, the more it will encreaſe in quantity. It is not to be expreſſed of what benefit ſuch a work is, both for himſelf and poſterity.

The floor and foundation of the vault muſt be ram'd down hard and cloſe; the ſide walls, half an ell thick, may be built up with pebble, brick, or any other ſtones; but the arch of the vault muſt be done with bricks, prepared in this manner: take the earth for bricks, work it up with north or ſouth rain water and urine, of which you muſt have a ſufficient quantity ready beforehand; with this, work and form your bricks, and burn them like other common bricks. For example: take 12 barrels of brick earth, four of lime, two of ſalt, and one of ſaltpetre; all theſe are to be well work'd together, moulded and burn'd as uſual.

For the mortar wherewith the bricks of the arch of the vault are joined together, you muſt take four barrels of clay, four of lime, one of ſalt, one half of ſaltpetre, and half a barrel of ſheeps dung, all well work'd together, and moiſtened with the above rain water and urine, and tempered to a proper thickneſs for mortar. In the middle of the vault, let an opening be made, raiſed like a funnel, and ſecured with iron bars at top: after the vault is thus built and encloſed, raiſe a ground over it about three quarters of a yard high, with common putrified earth; but if it can be mixed with excrements or ſtable dung, it is better. This will be ſufficient for the ingenious adventurers to improve upon.

Another Method for furthering the Growth of Saltpetre, is the following:

FIRST erect ſheds, each of four poſts, nine or ten foot high, of a proportionable thickneſs, ſix foot diſtance from each other, faſten'd with joiſts, and thatch'd a-top. When your ſheds are ready, lay fat black earth, about a foot high, upon a level; then fling the following mixture, about three inches thick, upon it, which is this: take ſalt 12 pound, ſaltpetre four pound, quick-lime 12 pound; this well beaten and work'd together, is fit for uſe.

After you have covered the firſt layer of earth with this mixture, then rake it well together with the earth, and when done, pour over it dung lee and urine out of a gardener's watering pot; then rake and wet it again a ſecond time.

After this, proceed thus with another layer of a foot high, ſo as to go up tapering, one layer after another, till it is about ſix foot high; then coat it all over with ſheeps dung.

You muſt obſerve to begin this work with the new moon; and after your heap has ſtood three or four nights, rake it all aſunder, and proceed as you did at firſt; this you muſt do in the time of the increaſe three or four times, and repeat it for three months together: in the decreaſe of the moon you muſt let it reſt, and after the three months are expired, you will have a very rich ſaltpetre earth.

Every ſhed or heap muſt be at leaſt eight feet diſtant from one another, for the benefit of the air. After you have brought ſeveral of thoſe ſheds to perfection, you may boil ſaltpetre ſucceſſively; for before you have done with three or four heaps, the firſt of them will be ready again to boil, and your earth, the more and oftner it is boil'd, will grow the richer.

N. B. For watering the earth, you may, if it can be got, uſe the pickle of herrings, or other ſalt-liquors, ſoap-lees after cloaths are waſh'd therein, alſo allum and other liquors that are flung away by dyers: you muſt alſo obſerve, to lay a coat of ſheeps dung over your heaps every time you have raiſed them.

Glauber, in his book, entitled *The Welfare of Germany*, when he treats of the growth of ſaltpetre, and the benefit it yields to many poor families, expreſſes himſelf in this manner.

'In the third chapter of the firſt part, about concentring 'of wood, the preſſing of wood to boil ſaltpetre, is only men'tion'd; but as wood is not plenty every where, and as it 'cannot in many places be ſpared, to cut it down for boiling 'ſaltpetre out of it, it may be brought to bear, that a large 'quantity of ſaltpetre may be produced out of the faded leaves 'of trees, as alſo out of wild graſs that grows under trees, ſo 'as to have no occaſion to cut trees down on that account. 'And in ſuch places where there is a ſcarcity of wood, but a 'plenty of corn, ſaltpetre may be prepared from ſtraw and 'ſtubble; and there is not a place in the world which does 'not afford matter for the produce of ſaltpetre. Wherefore I 'cannot neglect to communicate to all good and pious hus'bandmen a valuable art, by which they may provide and lay 'up a hidden treaſure, which thieves cannot ſteal, for their 'children, and for a relief to themſelves in time of diſtreſs, 'thereby reflecting upon God's providence, and remembring 'their tutor. For as in the ſaid treatiſe I have taught three 'choice ſecrets, both for rich and poor, great and mean; but 'they being uſeleſs to thoſe who have neither wine, corn, nor 'wood; I have thought it good, not to be forgetful of thoſe 'who are diſtitute of either, and are yet willing to provide 'for their wife and children, with honeſty in the fear of God, 'to teach them a beneficial art, hoping it will tend to the 'glory of God, and their own advantage.

'Firſt, then a young beginner ſhould have God before his 'eyes, and admoniſh his wife and children, if he has any, to 'fear God, keep his commandments, and love his neighbour. 'Then ſhall he determine within himſelf, to manage his for'tune left him by his parents, or which he had with his wife, 'with ſuch caution, care and frugality, as not to diminiſh, but 'to increaſe it every year; that when God ſhall viſit him with 'ſickneſs, or a charge of children, he may have ſomething 'laid by for a rainny day. Beſides this, he ought not to put 'his hands in his boſom, but turn them early and late to la'bour, and look for the bleſſing of God on his endeavours: 'and to him that has had but a ſlender fortune from his pa'rents, I give him a leſſon, in what manner he may lay up a 'treſaure for his children, without much trouble or pains.

'I the firſt place, let him build a ſhend north-eaſt of his houſe or habitation, if it can be done conveniently, elſe at any other place, ſo that the ſun and air may come at it, but the rain be kept out, in which ſhed make a deep pit; with the earth which is flung up, wall it in to keep out the rain-water: after this he ſhall begin to gather from day to day, and from year to year the below ſpecified things; ſo long, and as much, till one time or other, in caſe of neceſſity, he is obliged to dig for them, and to ſee what God has provided for him, and then reap the benefit thereof.

'The things he is to fling in, are all ſorts of ſharp and bitter plants, which grow in uncultivated places, hedges, and paths, and are no benefit to cattle, ſuch as are the thiſtles, wormwood, the large ſtalks of tobacco, which (if they are planted) are flung away; alſo the hard cabbage ſtalks and leaves, and other things unfit for cattle to feed upon; pine apples, if they are to be had, and in autumn the leaves of trees; alſo pigeon's and hen's dung, and the dung of any other creature. If you can have the feathers of poultry and wild birds, fling them in; fling alſo in all the aſhes whereof lee has been made, and fit for nothing but to be flung away; alſo the chimney ſoot, and from the ſlaughter-houſe the blood, if not uſed for any thing elſe; hog's hair, horns and hoofs of oxen and cows; the bones which the dogs can't gnaw, ſave them and fling them into the pit; and not only the outcaſte and ſcraps that are made in your own houſe, but alſo (to have the pit the ſooner full) thoſe of your neighbours, if they have no uſe for it themſelves; and thus one may in one or two years time fill a large pit with ſuch things; In the mean while the urine in the houſe muſt be ſaved, and flung into that place; and if you can alſo have it from your neighbours for that purpoſe, it is good; for thoſe things in the pit ſhould be kept always moiſt, in order to cauſe them the ſooner to rot If you can have no urine, take common water, or dung lee; but if you can have ſea water, or any other ſalt water, it is better; one may purchaſe at the fiſhmongers the pickle of herrings, alſo the brine of ſalt meat; for all the brine wherein meat has lain, turns to ſaltpetre.

'When you have fill'd the pit full, and it is well putrified, wet it no more, but let it lie ſo long till all is dry. Then, if

‘ you have occaſion for money, look out for a ſaltpetre boiler, and bargain with him what you ſhall give him to lee, boil, and ſell your ſaltpetre. When he has done this, let the ſaltpetre earth that's boiled out, be flung again into the pit, with the lee which did not ſhoot to ſaltpetre, and let it lie one or two years, and pour ſometimes ſome urine on it, or for want of that, common water; for that earth will yield ſaltpetre again, tho' not ſo much as it did the firſt time.

‘ But if you have no need for money, then let that treaſure lie, and as often as it is dry, moiſten it, to make the ſaltpetre grow and encreaſe more and more; and thus you may gather a hidden treaſure, and hardly know which way you come by it: if you do not want it, your children will find it; thieves will not rob you thereof, nor will the plunderers in time of war carry it along with them. When you have fill'd one pit, you may make another near it, to prevent the above ſpecified things from being flung away in waſte; and if in every village there were but one that would do this, the produce in a ſmall country would amount to a ſuprizing quantity in a year for the ſervice of the publick; and there would never be want of ſaltpetre.

‘ As ſoon as the ſaltpetre is ready, your money is ready, and gold and ſilver not far off. This mind, and be adviſed; you will ſurely grow once wiſe, and ſee how blind you and your equals have been; but praiſe God firſt, and be ſerviceable to your neighbour; for God has given it me, I give it you, give alſo ſomething to thy neighbour, and we are all helped.’

How to cleanſe Saltpetre.

PUT the ſaltpetre into a pot or crucible, ſet it on a good coal fire, till it is diſſolved like water. Then fling on one pound, about the bigneſs of a nut of coarſe pulverized ſulphur, and it will flame; when this with the ſmoak is vaniſhed, then pour the ſaltpetre into an iron flat pan, and let it congeal, which it ſoon will do, and loſes nothing; you may take an earthen diſh for this uſe, and pour the melted ſaltpetre out of the iron pan into it by degrees, letting it ſettle to the diſh round about, for which end you may have one that keeps the diſh in due motion to receive the ſaltpetre, beginning in the middle, and ſo let it ſpread in circular form. The ſediment in the iron pan will be of reddiſh hue and impure, which boil, and extract only what is ſerviceable.

A quick cleanſing of Saltpetre.

IF one is in haſte to have a quantity of ſaltpetre cleanſed, either for aqua-fortis or any other work, let him make a ſtrong lee, and diſſolve the ſaltpetre over a fire in a kettle; when all is diſſolved, pour the ſolution through a coarſe cloth into a veſſel; then rinſing the kettle, boil it again ſo long till it is fit for ſhooting; then pour it into a copper pan, and the clear ſaltpetre will ſhoot into cryſtals, and the ſalt remain in the lee.

Another Way to cleanſe Saltpetre.

TAKE ſaltpetre, as much as you will, pour freſh water to it as much as is requiſite for its ſolution, let it boil till all is diſſolved, and a great ſcum raiſed. Then have a tub at hand, which has a hole at bottom, under this ſet another tub; at the bottom of the firſt tub put clean waſhed ſand about ſix inches high, and over that a linnen cloth; upon this pour the warm lee, and let it run off, and the fœces and common ſalt will be kept back in the cloth and ſand; when it has done running, pour it again into the kettle, boil it as much as is requiſite to coagulate it; pour it out in troughs or copper pans as before, and the cryſtals will ſhoot in two or three days much finer and clearer, gather theſe; the remaining lee put again to boil; the oftner this is repeated, the clearer the ſaltpetre will be. *Or,*

TAKE two pound of quicklime, one pound of verdigreaſe, one pound of *Roman* vitriol, one pound of ſal armoniac, beat all to powder and mix and put them together; then put the mixture into a wooden veſſel, pour on it as much vinegar as is ſufficient to make a ſolution, or for want of vinegar you may uſe clear water, let it turn into a lee and ſettle for three days; then put the ſaltpetre into the copper, and as much of the aforeſaid lee as will cover it; boil it over a ſlow fire, till it is half conſumed, what remains take out of the copper, and put it into another veſſel, the fœces at the bottom fling away;

let the ſaltpetre lee cool, and proceed as has been directed above.

Another Method to purge Saltpetre after the firſt cleanſing; by Thurniſer.

PUT into a clean tub ſifted beech aſhes, pour freſh water upon them, ſtir them well with a ſtirring ſtick together, and let them ſettle; then pour the firſt water off, and pour freſh water to the ſettled aſhes; ſtir theſe as before, let them ſettle, and repeat this ſo long and ſo often till the lee is ſmooth and ſtrong enough, which you may learn by taſting a little of it on your tongue.

Then take the once cleanſed ſaltpetre, put it into a clean copper, pour on it the aſh lee about a hand high above the ſaltpetre, and meaſure the depth with any ſtick or rod to the bottom; then make a fire underneath, and boil it; when it boils, take the ſcum off with a ſcumming ladle, but let the lee be well drained from it, to prevent waſte; and when it has boiled ſo much away as the lee was above the ſaltpetre, which you may diſcover by your rod or meaſure, then drop from your ladle a few drops upon live coals, and if it gliſtens and emits a blue flame, it has boiled enough; but if you don't ſee this, then it is not boiled enough, and you muſt keep on boiling it till it gives a blue fire. Then take a clean veſſel, that's not too deep nor two ſhallow, place it where it may be cool, ſpread over it a double or treble clean cloth, through this pour your boiled ſaltpetre into the veſſel; then cut ſome ſplinters of fir about a ſpan long, lay them croſs one another in the veſſel, and the ſaltpetre will ſhoot to them like iſicles; this ſaltpetre changes its name, and is called ſaliter, or refined ſaltpetre.

To Try the Goodneſs of Saltpetre.

LAY a little ſaltpetre upon an even clear table, fire it with a coal, if it crackles like common ſalt when put into the fire, it is a ſign that it has much common ſalt; if it yields a fat and thick ſcum, it ſhews that it is greaſy; when the ſaltpetre is burned, and there remain fœces, it is a ſign that it contains much earth; but when it gives a quick flame, and many ſparks and the table remains without any fœces, and burns like a clean coal without ſcum or cracking, it is clear. Alſo, if after the ſecond boiling there is but four pound out of a hundred diminiſhed, it is a ſign the ſaltpetre is good.

PART VIII.

Several choice CURIOSITIES.

Of the Regeneration of Plants.

TAKE the ſeed of any plant, which has been gather'd in a bright and clear day, to the quantity of four pounds. This beat in a glaſs mortar, and put it in a phial, ſtop it well up, and ſet it by in a warm place. When this is done, chooſe a fine evening in the month of *May*, and prepare to catch the dew you ſee is like to fall that night. Take the ſeed out of the phial, put it in a large earthen diſh, place that in a garden or field in the open air; and in order to catch more dew than what will fall into the diſh, you may hang ſome very clean linnen cloths about the gardens or fields, and gather the dew to the quantity of two gallons, by wringing it out of the linnen; put all your dew in a clean glaſs, and put the ſeed which has been moiſtened therewith, before the ſun riſes, again into the phial; ſtop it well up, to keep it from evaporating, and put it in its former place: filtre the gathered dew thro' a whited-brown paper, and then diſtil it till you ſee it free from all earthy particles; calcine the ſediment, and you will have a fine ſalt, which is preſently diſſolved in the diſtilled dew: of this impregnated with ſalt dew, pour ſo much into the phial upon the ſeed, as will cover it three fingers high at top. Then ſeal it with beaten glaſs and borax, put it into a warm damp place, or in horſe dung for a month; and after the expiration thereof, you will, by examining the phial, find the ſeed changed into a jelly, and the ſpirit thereof ſwim at top like a fleece of ſeveral colours. Between the fleece and the clayiſh earth you will ſee the dew, which is pregnated by the ſeed, and is united to its nature, reſemble a green graſs: hang theſe phials well ſealed, during the whole ſummer ſeaſon, in the open air, where the ſun may come at them; but if it ſhould rain, remove it into a warm and dry place, till the weather is fair, and then put it again in the open air. It ſometimes happens that this work is accompliſhed in two months time, and ſometimes it will require a whole year, according to the weather.

The marks or ſigns by which one may know that it is come to its perfection, are theſe: the ſlimy water at bottom ſwells up; the ſpirit together with the fleece, daily diminiſhes, and altogether grows thick and troubled; then you ſee in the glaſs, when the ſun beams reflect upon it, innumerable delicate atoms ariſing, yet very tender and without colour, much like cobwebs, and like ſhades of the growing plant, which fall ſuddenly, as ſoon as the ſun withdraws its beams from it. At laſt the ſlimy naſty matter at bottom changes into a whitiſh blue, out of which by degrees ſhoot out ſtalks, that branch themſelves into plants and bloſſoms, in the nature of the ſeed uſed for this experiment; but this phœnomenon is obſerved only in warm weather, for in cold weather it is inviſible till it becomes warm again. It will retain its quality as long as the bottle is kept whole.

A fine Curioſity to make Metals grow viſibly.

CALCINE fine and tranſparent pebble ſtones, by heating them firſt red hot, and quenching them in water; repeating this till you have reduced them to a fine powder. Of this take one part, and two parts of tartar, which has been reduced by ſaltpetre; put it in a clean crucible into fuſion; when cold beat it fine, ſtrew it upon a glaſs table or marble, and let it in a moiſt place flow to an oil, or rather liquid.

Of this liquid take about four, five, or ſix ounces, put it in a white phial, add to it a dram and a half of metalline calx, which has been diſſolved in aqua fortis; then let it evaporate till it becomes of the conſiſtence of the calx: let this ſtand, and when cold, you will ſee the metal grow, and blanch out in twigs of different colours, according to the calx you have put in.

N. B. It

N. B. It is to be obſerved, that the cauſe of this growth is the volatile acid meeting with a fixed alcali. We may conclude this from the following experiment; take quicklime and common ſalt, calcine them together to an alcali, fling it on barren ground, and it will make it fertile, and cauſe vegetables to grow and thrive thereon, by contracting the alcali, the acid, the air, and the volatile ſalt.

You diſſolve iron in *Spiritus Salis*, and abſtract the ſpirit from it till it is dry, and there remains a fiery red maſs; of this break about the bigneſs of a pea, put it together with the 'forementioned liquid into a phial, and in a few hours you will ſee a tree in full growth, of a dark brown colour. Gold for ſuch experiments is diſſolved in aqua regis; the other metals as ſilver, copper, tin and lead, are reduced by aqua fortis. The gold will produce a growth of a yellow colour; ſilver a blue; copper a green; tin and lead a white colour.

This affords a fine ſpeculation, particularly to thoſe who delight in the ſtudy of mineral productions.

Creſcentia Lunæ, *or the Philoſophical Lunar Tree.*

THE nature of the growth and increaſe of ſilver oar may viſibly be demonſtrated by the following repreſentation:

Take clean ſettled aqua fortis ſix ounces, diſſolve therein two or three ounces of fine corned or beaten ſilver, pour after this three times as much clean rain water on it; in this ſolution you put to one ounce of ſilver, three or four ounces of purified mercury, let it ſtand undiſturbed in the cold, and you will plainly and diſtinctly ſee, how by the help of the ſpirit of tartar and nitre in the aqua fortis, the ſilver and mercury work conjunctive, and form variety of pleaſant vegetables, proſpects of hills, rocks and vallies: This nature of the is ſuppoſed to be the beginning of the growth of metal oar in the mines.

Of Mines, and how to diſcover them.

HUMAN life would certainly have enjoyed more innocence and ſatisfaction, were it not for the riches and luſtre which nature dazzles their eyes with, and makes them indefatigable ſearchers into the innermoſt receſſes of the earth, to her hidden treaſure.

Thoſe ſubterraneous riches, are diſcovered ſeveral ways: 1. When after great floods of rain the current in the ſeveral channels waſhes and diſcovers the veins of oar which nature had concealed with earth, as happened formerly at *Freyburg* in *Saxony*.

2. Sometimes metal oars are diſcovered after a great ſtorm, when thereby trees are tore up by the roots that grew on the ſurface of gold and ſilver veins.

3. *Juſtin* relates, that *Gallicia* was very rich of copper and lead, and *Baramaus* of gold, and that it has often happened that husbandmen in plowing their land, have plowed up pieces of gold oar, and thereby diſcovered the mines thereof. Nay, it frequently happens that mines are diſcovered by digging of wells.

4. *Diodorus Siculus* mentions, that by the fire the ſhepherds made in the woods in *Spain*, the like mines were diſcovered.

5. It is reported for certain, that the lead mines at *Goſlar*, a city in *Lower Saxony*, were firſt diſcovered by a horſe beating his hoof againſt a lead oar; and the like has been done by ſwine, in routing up the ground, when they ſearch for acorns.

But all theſe are merely accidental: it is better therefore to have certain rules to direct one to the diſcovery of ſuch mines; which indeed are beſt learned by long experience; however, thoſe that have been obſerved, are the following:

1. When on the ſurface of the earth, pieces of oar of ripe metal are found, it is a certain ſign that veins of oar are three. By this was the rich mine at *Kuttenberg* in *Bohemia* diſcover'd; a friar walking there for pleaſure in a wood, found a little twig of ſilver, which ſprang out of the ground; he was ſo very careful as to cover the place with his cloak, and carry the good news to his convent.

2. When there is a white froſt all over the country, there will be none over the mineral veins, becauſe they ſend up ſuch warm fumes as diſſolve the froſt, and for this reaſon ſnow ſooner melts in thoſe places than in others.

3. It is a certain ſign that minerals are found in ſuch places where the ſhrubs and trees are obſerv'd to fade by the latter end of the ſpring, become ſpotted and of a reddiſh colour.

4. A hill, the foot whereof looks towards the north, and the top towards the weſt, holds for the moſt part ſilver oar; the ſilver inclining from weſt to north.

5. By carefully examining into the colour of the earth, one may conjecture whether there are mineral oars there: and the colour of the mineral earth will ſhew what metal it carries; a greeniſh earth denotes copper; black gives good hopes of gold and ſilver; but the grey and white of none but iron or lead.

6. Dry, barren, and, as it were, burnt up hills, contain ſome metal, becauſe all the hurtful vapours that exhale out of the mineral veins, dry up the plants.

7. When ſtones or earth are heavier than ordinary, it is a ſign of mineral veins.

8. The ſprings at the bottom of hills often diſcover mines, either by their colour, ſmell, or taſte, or by carrying ſome ſmall metallic ſubſtance, whereby one may perceive that there are mineral veins.

9. Some, but not many plants and trees which have ſympathy with metals, grow commonly over oar mines, and give thereby notice for the diſcovery of them; as juniper, wild figs, and moſt plants of a prickly growth. When hills are always covered with vapours and ſmoak, it is a ſign that there are metallic veins.

Theſe are the directions which are followed by ſuch as are in ſearch of mineral oar, as they are ſet down by *Agricola*, *Cardan*, *Glauber*, and *Kircher*. This laſt author proceeds thus: “Laſtly we muſt allow, that all the ſigns for the diſcovery of mines here mentioned, are founded on a weak bottom, and that there is none of thoſe ſuppoſed marks, whereby one can be ſure and certain, after you have diſcovered the place that contains oar, neither what quantity, or what kind it holds; for theſe ſigns will direct as well to ſulphur, antimony, ſalt, mercury, lead, iron, copper, tin, as to ſilver and gold. But by virtue of the winchel-rod, one may with confidence diſtinguiſh the one from the other, and know what kind of oar the mines contain; for by holding in each hand a piece of gold, the rod which thereby attracts the atoms of the gold, will beat or move to no other metal; with ſilver it will do the ſame. As thoſe who profeſs themſelves profeſſors of that art, affirm”.

How to ſearch for, and find Springs.

VItruvius, in his treatiſe of architecture, takes notice of the following experiments, uſed in his time to diſcover ſprings; *viz.* 1. If one would certainly know where water is to be found, he ſhould a little before ſun-riſing lie flat upon his belly, and reſt his chin upon the ground, looking round about him; and if he ſees at any place a riſing vapour or fog, in ſuch place he may be aſſur'd of water. 2. In looking for ſprings, one ought well to examine the condition of the earth, becauſe in certain places you have ſeveral ſorts; the water that is found in chalky grounds, is neither plentiful, nor of a good taſte; that which is diſcovered under a light ſand, after you have beſtow'd much labour in digging deep enough for it, will be very little, and thereby ſlimy and diſagreeable; black earth contains the beſt water, becauſe the rain, which falls in the winter ſeaſon, ſoaks beſt into ſuch earth and (on account of its cloſeneſs) it preſerves water better than ſpongy earth. Springs that are in dark gravel, and thoſe not far from rivers, are alſo very good; tho' they afford no great plenty; but thoſe in coarſe gravel, pebble, or other ſtone, are more certain, and the water very good; ſprings in red ſand are alſo good and ſtrong, becauſe the water is not ſoaked up as in ſtone quarries. Thoſe at the bottom of hills, between rocks and ſtones, are the beſt, freſheſt, and moſt wholeſome. Springs in vallies are black, heavy, faint, and diſagreeable, except they have their ſource at ſome diſtance under the earth, or run through ſome ſhady grove of trees, whereby they are made agreeable and pleaſant; as is obſerv'd by ſuch as ſpring out in the vallies near hills.

Beſides the 'fore mentioned methods, there are others whereby one may conjecture the proper place to dig for ſprings; namely, wherever are ſeen (growing by themſelves) ſmall ruſhes, willows, and ſuch plants which thrive no where elſe but in watery places, it is a ſign there is water underneath them: but this is only to be obſerv'd in places that are free from pools, otherways rain-water may gather and occaſion the growth of ſuch plants, without the help of any ſprings. But if one cannot come at theſe trials the following may be ventured upon, *viz.* Dig a hole, three foot wide, and three or four foot deep, after ſun-ſet; then take a copper or lead baſon, diſh, cup, or what you will, anoint the inſide with oil, and ſet it on the bottom of the hole, with the inſide downwards; then fill the hole with leaves of trees, and over them put earth: the next day when you take up your baſon, and you find drops of water hang on the inſide thereof, it is a ſure ſign there is water in that place.

Or, put an earthen pan unglaz'd in ſuch a hole, and in the 'foreſaid manner; if there is water in that place, the pan will be wet and damp. Or, if you fling wool in ſuch a hole, and you can the next morning wring water out of it, it is a ſure ſign of a plentiful ſpring.

When a lamp, lighted with a little oil is put in ſuch a place, and neither the wick nor the oil conſum'd the next day, or the lamp damp, it is a ſign of a ſpring, and that the lamp has been fed with the damps thereof.

Another way is, by making a fire in ſuch a place, and when it is well heated, it will cauſe a thick vapour or ſmoak; which is a ſign of water.

Caſſiodorus will have it, that where ſubtile vapours or miſts ariſe in perpendicular pillars, in ſuch places one may be ſure of ſprings, which lie as deep under ground as the pillars are high. The ſame author recommends alſo for a ſure ſign that which the well-diggers have, who when after ſun-riſe they ſee a ſwarm of gnats as it were, in a cloud, they conclude that underneath them the earth contains ſprings.

Father *John Francois*, a jeſuit, is of opinion, that ſprings are beſt diſcovered by boreing, whereby the different earths under the ſurface may be brought up, and examined whether they have any ſign of water, or not: he adds, that ſuch gimlets might be made to bore through quarries of ſtone, and in caſe the gimlet ſhould not be long enough, to dig four or five foot deep, and help it further that way.

Farther *Kircher* gives us another method whereby to diſcover ſprings, or ſubterraneous water-courſes, which he tried with good ſucceſs, and is very eaſy to be put in practice: Make a ballance of wood, in the ſhape of a needle of a compaſs; one end muſt be of a kind of wood that will eaſily attract moiſture, as elder, willow, or the like This needle is ballanc'd between an axis, or is hang'd by the middle on a packthread, in place where water is ſuppoſed to be. If there really is water, the hand will ſoon looſe the ballance, and the point of elder incline towards the ground. This experiment is (ſays he) to be made in the morning early before the ſun has diſperſed the vapours of the earth

Theſe are the beſt of the common methods, which I know, to diſcover water ſprings; but how curious and ingenious however they are, the ſearcher is often deceiv'd by them. Father *Kircher*'s method, indeed, is the eaſieſt; but his project is not ſo much for diſcovering of ſprings, as to determine whether there is any water in that place.

But the *Winchel-Rod*, is the moſt wonderful invention for that purpoſe, that has yet been diſcovered, and the operation thereof is ſurpriſing; for by virtue of a hazel-rod or ſtick, not only the ſprings, but alſo their depth is eaſily diſcovered to a great nicety. Father *de Charles*, who made himſelf famous on account of writing a book intitled *Mundus Subterraneus*, after he has enumerated ſeveral ways of diſcovering ſprings, concludes thus: "There is another method to ſearch for water, "which is the moſt wonderful of all; but every one has not "the capacity of putting it in practice. The whole myſtery "conſiſts in this; a fork'd twig is cut off a hazel or mulberry-"tree, and he who ſearches carries it looſe in his hand, but as "ſoon as he goes over a ſpring, he will obſerve the ſtick to "turn in his hand, and incline to the place where the ſpring "is". A large account of this and the foregoing matter, is given by the author of the *Accurate Deſcription of the Winchel Rod*, written in *High Dutch*.

A Camera Obſcura.

CHOOSE for this experiment an apartment, from which you may have a proſpect into fine garden-walks or other places of reſort; contrive a hole, either through the wall, or elſe in a board fix'd in the window, in which fix a round glaſs of a pair of ſpectacles, and exclude all other light out of the room, but what enters through that glaſs: then at a convenient diſtance fix a ſheet of white paper or white cloth, and you will with delight ſee the objects without, repreſented thereon in their lively colours, eſpecially in a bright ſun-ſhiny day, you will ſee the birds in the air flying, ſhips (if you have ſuch a proſpect) ſailing, people walking, coaches riding, and every thing elſe appear in ſuch beauty and order, as will excite your admiration to conſider how the colours are diſpoſed in their proper ſhades and attitudes; and how when two different colours meet, the one is not changed by the conjunction of the other; beſides other ſpeculations it may afford, both uſeful and entertaining.

It is to be obſerved, that all the images which fall through the glaſs upon the paper, cloth or white wall, appear upſide down, and to have them repreſented upright, the following experiments have been approved of; the firſt is, by fixing another glaſs of a larger circumference at the outſide of the apartment, before the other glaſs is fix'd; this may be done when the two glaſſes are fix'd in a proper frame or tube made of wood or tin, for then they may eaſily be fix'd into a hole made for that purpoſe in the window-ſhutter or wall, but the objects will not appear ſo plain and clear as through a ſingle glaſs.

We will here preſent the curious with a model and deſcription of a moveable *Camera Obſcura*, whereby he may draw things, relating either to orthography or ichnography, to the greateſt perfection. The machine is prepared with as little trouble as expence, in the following manner.

Make a cubical or an even-ſided frame, and cloſe all the ſides round with thick paſte-board; In one of the ſides make a little hole, wherein fix a glaſs through which the images of the proſpect may enter; fix a white paper oppoſite to the glaſs at a proper diſtance, and having made a little hole near the glaſs, you may through that ſee the objects in a beautiful manner on the paper, which enter through the glaſs.

To Illuminate an Apartment with various beautiful Colours.

PUT three or four priſms, or glaſſes together in a triangular form in a frame, ſo as to make it portable, as you ſee in the figure A, B; let the priſms be ſo fix'd by your corners, that on one ſide they may make a flat, and on the other a trigonal face, as in the figure; place this frame thus finiſhed under a window towards the ſun, ſo that the flat ſide be towards it, and if there be any more windows in the apartment, let them be ſhut up. As ſoon as the beams of the ſun ſhine through theſe trigonal glaſſes, your apartment will appear like a paradiſe, in the greateſt beauty, and of various colours. If your receive theſe beams on a concave glaſs, you will ſee the colours change quite different from what they were before; and if you look through thoſe glaſſes into the ſtreet, you will ſee every thing in different colours, ſo that you will be in a ſort of ſurprize or admiration.

Diana, or the Philoſophical Tree.

THIS operation is mixture of ſilver, mercury and ſpirit of nitre, cryſtallized together in the ſhape and form of a tree.

Take one ounce of ſilver, and diſſolve it in two or three ounces of ſpirit of nitre; put this ſolution into a matraſs or glaſs phial, into which you have put 18 or 20 ounces of water, and two ounces of quickſilver. Let your phial be fill'd up to the neck, and place it in ſome convenient place where no body can meddle with it, for 40 days together, in which time you will ſee a tree ſpread forth in branches, with little balls at the ends thereof.

Another Method.

DISSOLVE an ounce of fine ſilver in three ounces of aqua fortis, in a phial or ſmall matraſs; evaporate about half that moiſture in a warm ſand by a gentle fire; then add to it three ounces of good diſtill'd vinegar, heat it a little, and ſtir it about; then put your matraſs in a ſafe place where it may reſt for a month, and you will ſee a tree growing to the very ſurface of the liquor, and reſemble in its branches a fir-tree.

Curious Secrets for preſerving Things from CORRUPTION.

To preſerve Things from Corruption in Spirit of Wine.

THIS is done in the moſt ſubtil rectified ſpirit of wine camphoriz'd; wherein many ſorts of animals, as birds, fiſh, inſects, reptiles, *&c.* may me kept many years from decaying or corruption. *Porta* relates, he had ſeen a fiſh at *Rome* thus preſerv'd for above 20 years, which was as freſh as if alive: likewiſe at *Florence* he ſaw one that had been preſerv'd above 40 years. The glaſſes, wherein they were kept, were hemetically ſealed, to keep the leaſt air from coming to them.

The Preparation of the Spirit or Oil of Salt, whereby Things may be kept from Corruption, and which is a great Reſtorer and Preſerver of Heath.

TAKE ſea-ſalt, as much as you pleaſe, put it into a pan or crucible cover'd, over a good coal fire, and when it has done crackling, take it off, put it in a damp place, till it is diſſolv'd; filtre it often through a paper, till it is thoroughly clear and fine. Then let it digeſt in horſe-dung, for about two months, changing the dung often for freſh, in order to keep it continually warm. Then diſtil it over ſome ſand, and you will have in your receiver a ſalt oil, with a watry phlegm, diſtil this gently in a *Baln.* and the oil will remain behind, but the watry ſubſtance be carried off; whatever is put into this oil, will keep from corruption without changing, for ages. This is the ſalt ſpirit which by *Paracelſus* is called *Vividitas Salis*, and has incomparable virtues, as well to reſtore men to health and vigour, as alſo to preſerve them from moſt diſtempers; four or ſix drops taken in wormwood water, is good for the dropſy, convulſions, and the yellow jaundice;

three or four drops taken in harts-horn-water is good for all ſorts of agues; for worms, it is taken in brandy; three drops taken in *Carcit*, or water of *Carduus Benedictus*, it is good for the ſtoppage of urine. It is a fine remedy for all ſorts of ſprains and contractions of the nerves; it heals bruiſes and ſwellings, when mix'd with other ointments, and the affected parts are anointed therewith. When mix'd with oil of turpentine or wax, or camomile, it will aſſuage the gout. This oil or ſpirit of ſalt, if well rectified, is a ſolvent for all ſorts of metals and ſtones, and a key to many hidden myſteries.

But if this preſervative is too coſtly to keep things from corruption, you may prepare a ſea-water with a ſmall expence, which will keep things for many years; and this you may do in the following manner;

After you have ſearced your ſea ſalt, diſſolve it in diſtilled rain-water, and make thereof a lee which will bear an egg.

Or, when the ſalt is ſearced, put it into a damp place, and when it is diſſolv'd, filtre it through a paper ſo long till it is clear and fine. This you may uſe to preſerve things from corruption, by diſtilling it, and pouring it over the thing to be preſerved.

A Regeneration of Coral.

TAKE verdigreaſe three pound; live ſulphur one pound; clear ſand four pound, pulverize and mix them; then diſtill them in a retort on ſand, firſt with a ſlow fire, but augmenting it by degrees, it will produce a ſpirit, which has a ſweetiſh ſour flavour.

If you pour this ſpirit upon powdered coral, or harts horn ſhavings, which by a gentle warmth is quite dry'd up, then you put it into a phial with ſome diſtill'd rain water, and ſet it in a warm place well cloſed up, the coral or harts-horn will ſhoot and grow ſo natural that it will be a delighful ſight.

To prepare a Phoſphorus.

TAKE urine, as much as you pleaſe, put it into a tub or kettle, let it ſtand for three weeks or a month together and putrify, then boil away the humidity till the remainder becomes a black and tough matter. Of this take one pound, oil of tartar fœtid, or the ſtinking oil of harts-horn, or for want of that, green wax; mix it well with the matter, put it into a retort, ſet it on a ſtrong fire of a reverberatory furnace, fit to it a large receiver, lute the junctures, give firſt a gentle, and laſtly for four hours the fierceſt heat you can; and you will find in the receiver, in the firſt ſediment the volatile ſalt, then ſome oil, and after that the phoſphorus, which in the receiver is ſublimated of a yellowiſh colour; let the firſt ſediment ſtand over night and grow cold, then take and waſh with the liquor that is at the bottom, all the phoſphorus and oil, mix them well together, put them into a matraſs, diſtill them out of a ſand coppel, and you will find in the firſt ſediment grains of phoſphorus, which whilſt warm form into little ſticks, and preſerve them in a little phial as the former

Another Proceſs of making the Phoſphorus.

TAKE a conſiderable quantity of human urin, digeſt it for a pretty while, before you uſe it, then diſtill this liquor with a moderate heat, 'till the ſpirituous and ſalineparts are drawn off; after which the ſuperfluous moiſture will evaporate, and remain in ſubſtance, will be brought to a conſiſtence of a ſyrup; incorporate this with thrice its weight of fine white ſand, and put it in a ſtrong ſtone retort; to which join a large receiver, fill'd in a great meaſure with water, ſo that the noſe of the retort may almoſt touch the water; then lute the two veſſels carefully together, give it a graduated fire for 5 or 6 hours, to bring over all that is phlegmatic or volatile; this done, encreaſe the fire, and at laſt for 5 or 6 hours more make it ſtrong and intenſe, as poſſible you can, by which means there will firſt come over a large quantity of white fumes, which in a little time will be ſucceeded by another ſort ſeeming to yield a faint blewiſh light in the receiver; laſtly the fire being vehement there will come over another ſubſtance more ponderous than the former, and fall to the bottom of the receiver, which you take out and preſerve, and which is the real phoſphorus.

Another ſuch luminous Matter.

TAKE what by moſt apthecaries is called land emerald, as much as you will, beat it fine with water on a ſtone; temper it with gum or honey water, and write or paint therewith upon a poliſhed copper or iron plate, whatever you will, and let it dry; then lay it upon a charcoal fire, or ſet it before the ſame, and a little while it will ſhine, ſo that when you bring it into a dark room, or put the candles out, the company who are ignorant of what is done, will be ſurprized at ſo ſudden and ſtrange an appearance.

To prepare a Room or Cloſet in ſuch a manner that any one entering with a lighted candle, will think himſelf ſurrounded by Fire.

TAKE a pretty large quantity of brandy, and put it in a bowl; ſet it on a ſlow coal fire, to receive heat enough to boil it gently up; into the brandy fling ſome camphir, cut in little bits, which will ſoon diſſolve, and when all is diſſolved, cloſe both windows and doors, and let the brandy boil and evaporate; by this the whole ſoom will be fill'd with ſubtle ſpirits, which, as ſoon as a candle is brought in, will be lighted, and ſeem as if all was on fire. If ſome perfume is diſſolved in the brandy, the flame will be attended with a fine ſcent.

To prepare a luminous Stone.

TAKE good rectified ſpirit of nitre, fling quick lime and chalk into it, till the ſaid ſpirit can diſſolve no more, and ceaſes to bubble; filtre the ſolution, put it into a retort, and diſtil the ſpirit of nitre from it again; what remains in the retort, place in the air, and let it diſſolve; then put it again into the retort, draw off the moiſture; till it is dry; ſet it again in the air, and let it diſſolve; then put it into aſſay-cups, pnt them into a cucurbit, and diſtill all the moiſture from it; what remains put under a muffel to harden. Then hold it in the light of day, of the moon, or the light of a candle, and it will attract that light, ſo as to emit it again, when put into a dark place.

The Preparation of a Phoſphorus.

TAKE an earthen plate or diſh, which is not glazed, about half an inch thick; and make a ſort of paſte of ſpirit of nitre and pulveriz'd chalk, well ſtirred together; of this take the bigneſs of a ſhilling, put it into the plate, and and ſet it on the fire under a muffel (where it will bubble very much) to dry; when dry, take it out, let it cool, and mix it up with ſpirit of nitre; this do ſix or eight times and it is done: After it is cold, hold it a little while againſt a candle, and ſhewing it in a dark place, you will be ſurprized at the light it gives.

How to prepare Thunder Powder.

THIS is done with three ingredients, namely, three parts ſaltpetre, two parts of ſalt of tartar, and one part of ſulphur; theſe are pounded and mixt together: if you take about 60 grains in a ſpoon and warm it over a candle or other fire, it will give a report, like a cannon fired off, and the flaſhing will beat downwards; if you make uſe of a copper ſpoon or cup, you will after the report find a hole at bottom; but when fired at top, it will burn away like lightning.

To prepare a ſtone, which being wetted produces Fire.

TAKE quick-lime, ſalpeter, tutia alexandrina, calamint of equal quantities; live ſulphur and camphire of each two parts, beat them fine and ſift them thro a fine ſive, then put the powder in a new linnen cloath, tie it cloſe; put it into a crucible, cover it with another crucible mouth to mouth, bind and lute them well, then ſet them in the ſun to dry: when dry the powder will be yellow. Then put the crucible in a potters furnace, and when cold again take it out and you will find the powder alter'd into the ſubſtance of brick: this you may form into leſs proportions, and when you have occaſion to light a candle or fire, wet part of it with a little water or your own ſpittle and it will inſtantly flame: when you have lit your fire, you may blow it out again as you do a candle.

To repreſent a philoſophical Tree in a Glaſs.

TAKE of the fineſt ſilver one ounce, aqua fortis and mercury of each four ounces; in this diſſolve your ſilver in a phial, and after you have put over it a pint of water, cloſe your phial, and you will ſee a fine tree ſpring forth in branches, which will encreaſe and grow thicker every day.

To repreſent the four Elements in a glaſs Phial.

FIRST tincture in a phial, good ſpirit of wine with *Terra Solis*, to repreſent the air; then take well rectified oil of turpentine, this you are to tincture with ſaffron, and red ox-tongue root for fire; oil of tartar, to which you muſt add a little ultramarine, to give it the colour of ſea or water; and to repreſent the earth, take a little ſmalt. This you may ſhake together, and after it has ſtood a little, every thing will take its place again, for the three liquids will never keep or unite together. *Or,*

HAVE a glaſs made in the ſhape of an egg, fill the fourth part thereof with clean ſmalt, or common antimony, (*a*) to repreſent the earth; for water (*b*) take ſpirit of tartar; for the air (*c*) ſpirit of wine three times rectified, and oil of *Benjamin*, which in colour and brightneſs may repreſent the fire; (*d*) the cover of the glaſs may be ornamented with a flame, or what you pleaſe.

A Florence flask will anſwer the ſame purpoſe made with a foot to it, as you ſee in the figure.

An elementary World in a Phial.

TAKE black glaſs or enamel, beat it to a middling gravel ſize; this, for repreſenting the earth, will ſettle at the bottom; for the water you may uſe calcined tartar, or ſand aſhes, which you muſt firſt moiſten, and what thereof diſſolves pour the cleareſt into the phial, and tincture it with a little ultramarine, to give it the ſea colour; for the air uſe aqua vitæ, the beſt you can get, which wheu tinctured with a little turnſole, gives a sky colour; to repreſent the fire, take linſeed or oil of turpentine, and prepare the latter thus: diſtill turpentine in *Baln. Mar.* the water and oil will raiſe tranſparently together, but the oil will afterwards ſwim at top, which take, after you have coloured it with ox-tongue and ſaffron. All theſe materials differ both in weight and quality, for if you ſhake them together, you may indeed obſerve a little while a chaos full of confuſion and diſorder, but as ſoon as you ſet the phial down, each ingredient takes its reſpective place in the ſame order as before.

To ornament a Room with a continual moving Picture.

PLACE a large picture againſt the wainſcot, in a ſummer houſe, or any other room where the wind may be convey'd to the back of the picture; bore little holes through the wainſcot, to correſpond with ſome paſte-board wheels that are at the back of the picture; the wind which blows on them through the littles holes, will put them in motion, and having on the right ſide of the picture ſuch things painted and fix'd to the paſte-board wheel on one ſpindle, they will have an equal motion with them: and there may be ſeveral things repreſented in a picture, and their motion made agreeable; as for example, a man grinding of knives, a woman at her ſpining-wheel, a wind or water mill, and ſeveral other fancies as a man's curioſity will direct him to.

To make Microſcopes to a great Perfection.

TAKE a lamp with ſpirits of wine, and inſtead of cotton uſe very ſmall ſilver wire, doubled up like a skean of thread; then take of beaten glaſs, after it is well waſh'd and cleanſed a little quantity on the point of a ſilver needle filed very ſmall and wetted with ſpittle, then hold the bit of glaſs in the frame of the lamp, 'till it is quite round, but no longer, for fear of burning it; and if the ſide of the glaſs, next the needle is not melted, then turn the rough ſide to the flame, 'till it is every where equally round and ſmooth, then wipe and rub it with ſoft leather, and afterwards put it between two pieces of thin braſs, the apertures muſt be very round, and that towards the eye almoſt as large as the diameter of of the glaſs, and ſo place it in a frame with the object.

Of the Regeneration of ANIMALS.

Of Craw-fiſh.

IT is to be obſerved that if you will ſucceed in this experiment, you muſt chooſe the full moon, and if poſſible, when in a watry ſign; then take a parcel of live craw fiſh, which are caught in rivulets and brooks, divide them in two parcels; one parcel put into an unglaz'd earthen pan, lute it well, and put it into a furnace to calcine for ſeven or eight hours in a ſtrong fire: after they are well calcined, beat them in a marble mortar to powder; then take the other parcel, and boil them in the ſame water they were caught in, pour off the water into another veſſel, about half a pail full, and fling into it about half a handful of the calcined craw-fiſh, ſtir it well together with a ſtick, then let it ſettle and remain quiet, and in a few days you will obſerve in the water a great number of ſmall atoms in motion. When you ſee them grow up to the bigneſs of a ſmall button, you muſt feed them with beef blood, flinging thereof by little and little into the water, which will cauſe them to thrive, and to grow to their natural bigneſs; but you muſt obſeve, that before you put them into the veſſel with water, you are to lay ſand at the bottom about an inch thick.

Petro Borelli, in the 34th paragraph of his phyſical hiſtory ſays, 'If one takes the aſhes of craw-fiſh, and lay them 'in a damp place or in an earthen pan, moiſtened with a little 'water, and lets it ſtand, in leſs than 20 days there will be 'ſeen innumerable little worms; and after this you ſprinkle 'beef blood upon it, they will by degrees turn into craw-'fiſh."

The Sieur *Pegarius*, where he treats upon this ſubjects, ſays, ‘ As to the generation of animals, a friend of mine did ſee ‘ the figures and ſhapes of craw-fiſh, in a lee he made of calcin’d ones; but what is more ſurprizing, out of ſuch a ſalt, ‘ not only the reſemblance of ſuch creatures is produced, but ‘ alſo the very animal itſelf, alive and in its natural form and ‘ ſhape; as D. *de Chambulan* and others have experienced, by ‘ flinging the powder of calcined craw-fiſh into ſtanding water; ‘ the like may be done with the aſhes of toads. *Rochos* in ‘ his *Art of Nature* writes that out of a rotten duck have ‘ grown ſeveral toads, becauſe ſhe had fed upon theſe creatures; and that the carcaſs of an owl which has fed upon ‘ jacks, will bring forth great numbers of that fiſh after it is ‘ rotten; and if the ſaid owl has fed upon carps, the rotten ‘ carcaſs will produce carp: and from hence it is, that when ‘ a fiſh pond is quite dried up, and water is again let in, it will ‘ abound in a little time with fiſh of ſuch ſort as never were ‘ in before.”

Of Eels.

KIRCHER in the firſt part of his ſubterraneous world ſpeaks thus of eels.

Eels grow without a ſperm or ſeed, out of the skin they throw off yearly, which corrupts; or of what ſticks to the ſtones againſt which they rub; the truth of this may be eaſily experienced, by chopping an eel into little pieces, and flinging them into a muddy pond, for in a month’s time there will appear a brood of ſmall eels.

Another generation of eels is performed thus; take two pieces of turf, let them lie that the dew may fall upon them, then lay them graſs to graſs, and put them into a pond or ditch, ſo that the water may play upon them, and you will ſee firſt little worms come from between, which in time will grow up to eels.

According to *Ariſtotle*, there is neither male nor female of eels, neither do they copulate, or ſpawn, and there never is an eel found with either a hard or ſoft roe; from all which it may be conjectured, that when a ſlimy water has been quite drain’d off, and the ſlime been taken out, there has ſtill been a production of eels when freſh water has been let in again; for in a dry ſoil they don't generate, nor in the ſea that is always full of water, becauſe they have their growth and nouriſhment from rain.

They are alſo generated out of other corruptible things, and we have ſeen, when a dead horſe has been flung into the water, a vaſt number of eels have been perceived about the carcaſſes; and it is thought they come forth from other dead carcaſſes alſo. *Ariſtotle* ſays, they have their firſt origin, in the inner receſſes of the earth, where ſome of them break out into the ſea, or others in rivers and ponds.

That vegetables produce all ſorts of inſects, and in particular flies, we find in *Aldrovandus*'s third book of reptiles, where chap 16, he ſays thus: 'As I will not deny that out of the 'moſt putrified matters, even out of carrion, grow flies, I do 'believe that moſt of them have their origin from vegetables, 'as we have examples of our own experience; for a few years 'ago, in a winter ſeaſon, when for want of other green plants 'I pounded brown-cabbage, and left them ſome time in my 'room, I found that worms grew out of them, and that theſe 'worms turn'd into lady-birds; I gathered them into a box, 'and opening the box ſome time after, a great ſwarm of 'little flies flew out of it, which before had been lady-'birds.

Something of the ſame kind did a good friend and correſpondent commnnicate to me in a letter, *Dec.* 28th 1671. He writes thus: 'I once read in an *Italian* author, that out of '*Cheledonia* a tincture could be prepared; this did prompt me 'to make a ſtricter ſearch into the nature of that herb; I took 'the whole plant, chop'd it fine, when it was full of juice, and 'put it into a matraſs; then I luted a head upon it, thinking 'to diſtil it in *Baln. Mar.* but by ſome accident it remained 'almoſt a whole ſummer neglected in my laboratory. To-'wards autumn I found that the whole maſs was liquified and 'full of worms; hence I could eaſily perceive what a fine 'tincture I had to expect, however, I let it ſtand the whole 'winter; in the beginning of the ſpring I found that the 'worms, were all gone, and all was turned into a black pow-'der; not long after out of this powder grew gnats, in ſuch 'abundance, that the whole glaſs was full of them, which 'made a buzzing noiſe and flew about. I was in the interim 'viſited by an acquaintance, who ſpied the glaſs with the gnats

‘ as it ſtood in the window; we fell into a diſcourſe about ‘ them, when he maintained that thoſe gnats would not bear ‘ the open air, but die as ſoon as it was conveyed to them. ‘ I could hardly believe it, but to try the experiment, I pull'd ‘ the ſtopple out of the retort, and perceived all the gnats ‘ dead in a moment; after I opened the glaſs, I found that moſt ‘ of the powder was turned into gnats, except a very little ‘ black earth, which I tried, and found the taſte very fiery, and ‘ produc'd after it was light, a fix'd ſalt, which without doubt ‘ may have its particular virtue.

Scaliger ſays, that every tree and herb has its particular worm or inſect, and almoſt every ſmall vegetable its own fly. This a virtuoſi at *Rome* obſerved in his garden, and had them painted together with the plant in their natural colours; but we need not go ſo far as *Rome*, we may ſatisfy our curioſity by peruſing Mr. *Albine*'s natural hiſtory of *Engliſh* inſects.

Peganus's *Relation of what happened, with his Experiment in the Generation of Serpents.*

‘ WHEN, *Anno* 1654, among other authors I happened ‘ to read *Theophraſtus*'s book *de Vermibus*, where he ‘ in particular gives a ſurprizing account of the *German* notters ‘ (vipers) and having a deſire to try the experiment of ſo great ‘ a curioſity, I ordered 25 notters to be caught; I had them ‘ skinned, flung the heads and tails away, and ſaved the heart ‘ and liver for a particular uſe, after I had made them into ‘ powder; the fleſh and bone I cut in little pieces, put them ‘ into a glaſs matraſs, ſet over that another, and luted them ‘ cloſe together.

‘ This I did in *July*, in my laboratory at the window where ‘ the ſun only ſhined a few hours upon it; I let it ſtand for two ‘ months, and obſerved every day whether there appeared any ‘ change in the glaſs; after a few weeks I ſaw ſome oily or ‘ greaſy drops hang to the upper glaſs, which were of a yellowiſh colour; after I had look'd with great attention upon ‘ theſe drops for an hour together, I obſerved iſſuing out of them ‘ ſnow white worms very ſmall, which crept downwards; and ‘ as theſe worms encreaſed daily more and more, the firſt of ‘ them grew bigger, but the matter at the bottom of the glaſs ‘ ſtood like a yellowiſh oil with ſome watry moiſture, and the 'ſediment at the bottom appeared to be a black earthy 'ſubſtance; after ſome weeks the number of worms began 'to decreaſe, the reſt increaſed in growth; and at laſt they 'were all vaniſhed to three or four, which were about a 'finger's length, and had an uncommon brightneſs. In a 'few weeks they were all loſt, except one, which was pretty 'long, and had the reſemblance of a ſerpent, but was of a 'ſnow white colour, ſmooth and ſhining, without ſcales, 'although there were very ſubtil black lineaments acroſs, 'which in the glaſs I could not well diſtinguiſh; the head 'differed alſo ſomething from that of a ſerpent, the reſt 'of the maſs grew dry, and reſembled a black cloſe earth: 'I was in one reſpect rejoiced to have the happineſs of 'ſeeing this curioſity of nature, in regenerating a ſerpent, 'but on the other hand I was cautious how to bring the 'creature out of the glaſs, and how to proceed further there'with; at laſt fear got the upperhand of reaſon, and in a 'ſort of horror I took the glaſs and flung it into an houſe of 'office.'

Of the Generation of Silk-Worms out of Veal.

TAKE about 10 or 12 pound of veal, all meat without bones, warm, and as ſoon as it is kill'd; chop this with a chopping knife as fine as you can, afterwards put it into a new earthen pot, thus: at the bottom make a layer of mulberry-leaves, then a layer of veal, and thus proceed till your pot is full; then cover the top with mulberry-leaves, and take an old ſhirt, which has been well wore and ſweated in by a labouring man; put this at top upon the leaves, and then tie the pot cloſe with leather. After this is done, ſet the pot into a cellar, which is not too cool, but ſomething warm and damp, let it ſtand for three or four weeks, till the veal turns into maggots, which happens ſometimes ſooner, ſometimes later, according to the nature of the place into which you put it. Of theſe maggots take as many as you will, and ſet them upon freſh mulberry leaves which they will eat; change their form to ſilk-worms; will ſoon content themſelves with that nutriment, and ſpin and generate like other ſilk-worms. I have produced them twice, not without the admiration of the late Mr *Sperling*, and yet I am of opinion that this generation is not of both, but only of one kind ; the ſame opinion I have of toads or frogs, which are produced out of barren earth.

The time wherein ſilk-worms are to be raiſed, is in the beginning of *July*, to the eighth of that month, when the proceſs is to begin. *Vida* in his ſecond book of ſilk-worms teaches, when a young ox is fed with mulberry-leaves that out of his fleſh, after he is killed, will grow ſilk-worms *.

A particular Method to furniſh a Fiſh-pond with variety of Fiſh.

TAKE about the latter end of *April*, or the beginning of *May*, the root of a willow that ſtands near the water ſide, and is full of fibres ; waſh the earth about it clean away ; then tie it to a ſpike, which drive into a river or fiſh-pond, that is well ſtored with variety of fiſh ; they will preſently ſtrike about and againſt the root, and void their ſpawn or row, which will hang to the fibres ; after a few days take the ſpike with the willow root out of that river or fiſh-pond, and convey it to that which you deſign to ſtore, driving it about a hands breadth deep under the ſurface of the water, and in about a fortnights time you will perceive a great number of young fiſhes. Be careful that you leave the root not too long in the firſt pond or river ; leaſt the heat of the ſun animate the ſpawn, and ſo it diſengages from the root.

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* Since the publication of the ſecond Edition, we have met with an authentic account, in the *Breſlaw* Philoſophical Collections, of a Proceſs made by Dr *Lanckiſh*, Phyſician at *Lignitz*, in *Sileſia*, in the moſt niceſt manner ; but after having tried various experiments for ſeveral ſummers ſucceſſively, he never could produce any real Silk-wonms, but the putrefaction of the veal he has prepared, according to the directions given above, turn'd firſt into large maggots, and having ſpun themſelves into cryſolites, they became afterwads beautiful large flies. But as the above account is atteſted by ſeveral credible Authors, we would not omit it in this Edition, for the further ſearch and enquiry of the curious.

PART

PART IX.

Several Curious and Uſeful Inſtructions in the Art of DISTILLING.

How to extract the Quinteſſence of Roſes.

TAKE freſh roſes, which are gathered before ſun-riſing, whilſt the dew is upon them; bruiſe or ſtamp the leaves thereof in a ſtone mortar, then put them into an earthen glaz'd pan or bowl; cover them cloſe, and let them ſtand till they putrify, which you may perceive when the ſcent thereof is ſour, and it turns ſo in about twelve or fourteen days; you may mix up with the leaves a a little ſalt of tartar, for this penetrates, cuts, and ſeparates the contrary particles, and will cauſe each the better to ſeparate.

After the roſe leaves are thus putrified, take the fifth or ſeventh part of them, put them into a glaſs cucurbit, and diſtill them in *Baln. Mar.* Pour the diſtill'd water upon the other part of the leaves, and after you have emptied the cucurbit of the firſt leaves, put in the ſecond part, and diſtill them in *Baln. Mar.* as before; thus repeating it, you will draw a rectified water, which contains the ſpirit, and muſt be ſeparated in the following manner; put all the water you have diſtill'd into a matraſs with a long neck, and a head to it, lute a receiver to it; then with a ſlow aſh-fire draw off the ſpirit; and as there will go ſome of the phlegm along with it, the ſpirit muſt be together with the phlegm diſtilled again with a ſlower fire; and thus you will have a pure ſpirit of roſes, which will diffuſe it's ſtrong ſcent as ſoon as the matraſs is opened, over the whole room.

Save this ſpirit, well cloſ'd up in a phial, as a pecious and valuable thing; for it's virtue is wonderful and admirable. Pour the greater part of the diſtill'd roſe-water over the already diſtill'd roſe-leaves, in order to extract the oil from the water;

which muſt be done by diſtilling it over a hotter aſh-fire, than you did the ſpirit: the oil will ſeparate itſelf from the phlegm, and ſwim on the ſurface of the water in a gold-colour; and although the quantity be but ſmall, the virtue thereof is great and valuable.

Separate this oil from the phlegm, and put it up apart by itſelf, and alſo the diſtill'd roſe water in a glaſs by itſelf; after which take the diſtill'd roſe-leaves, from which all the ſpirit and oil is extracted, burn them in a crucible to aſhes, and in burning add a little ſulphur to them, give the aſhes a fierce fire, and they will be as white as ſnow.

Theſe aſhes put into a glaſs or earthen veſſel, pour over them the above phlegm or roſe water; boil it well, ſo long till the water has extracted all the ſalt from the aſhes; then filtre it through a brown paper into a matraſs; diſtill it, and carry off the phlegm, and a clear ſalt will ſettle at the bottom of the matraſs: the aſhes you may calcine a-new in a ſtrong reverberatory fire, then boil them up again in the phlegm, and draw out the ſalt as before; repeat this till all the ſalt is extracted, and there remains only a poor earthy ſubſtance.

In this manner are extracted from roſes the three pure capital principles, *viz* ſpirit, oil, and ſalt; and the three impure parts, phlegm, water, and *Cap. Mort.*

In caſe the ſalt ſhould not be clean enough, you muſt diſſolve it again in the phlegm, and repeat your proceſs by diſtillation, as before, and you may make it as fine as you will.

Each of theſe ſubſtances apart has great medicinal virtues, but much more if all three are united together, which is done in the following manner.

Put the clear ſalt into a glaſs phial with a long neck, and ſet it in a gentle warmth; pour on it ſome of the oil, and continue the warmth till the ſalt and oil are united; then put another part of oil to it, and thus by uniting them by degrees, your boiling is finiſh'd. Then add to it one part of the ſpirit, and augment the quantity by ſlow degrees, as you did with the oil; and the three ſubſtances will be united, that no art is able to part them, and the medicinal virtues thereof are inexpreſſible.

Another

Another Method to extract the Quinteſſence out of any Vegetables.

TAKE a plant, herb, or flower in the month they flouriſh beſt; gather thereof before ſun-riſing (with the dew upon it) what quantity you pleaſe; chop it fine, and fill therewith a glaſs matraſs; lute the head over it, and place the matraſs in *Baln. Mar.* let it digeſt over a very ſlow fire for a fortnight, after which time augment your fire; when you find ſome of the menſtruum will go over into the receiver, then take your matraſs out of the *Balneum*, and you will ſee the herb infuſed in its own juice, which pour off into a clean glaſs; what remains of the herb take out of the matraſs, burn it to aſhes, and extract the ſalt thereof with a water diſtill'd from the ſame herb.

How to extract Oil of Herbs, Flowers or Seeds.

FILL a large cucurbit with herbs, flowers, ſeeds or what you pleaſe, infuſe it in good *Spiritus Salis*, ſet it in ſand, and give it fire enough to boil, and the oil, as well as the phlegm, will diſtill over into the receiver; which you may ſeparate as has been directed; the ſpirit you are to pour off, rectify it, and you may uſe it again for the like proceſs.

A curious Secret to diſtill Herbs, ſo that the Water will retain both the Colour and Taſte thereof.

TAKE the leaves of the herb you deſign to diſtill, infuſe them for a night and a day in rain-water, then take a ſtill head, pour into it ſome of the water from off the herbs, ſwing or rinſe it about, and pour it through the pipe on the herbs again; fling more freſh leaves upon it, put on the head, lute it cloſe, and diſtill it in *Baln. Mar.* with a ſlow fire, and you will ſee the drops, which have the colour of the herb or flower. When you have diſtill'd it all over into the receiver, then burn the leaves or aſhes, and extract the ſalt from it in the manner above directed; put half of it into the diſtill'd water, let it diſſolve in the ſun, and the colour will be clear and fine.

To make Vinegar of Wine.

1. FLING pieces of barley-bread into your cask of wine, and in two or three days it will be ſour.

2. Take rye-flower, mix it into a dough with ſtrong white-wine vinegar, then bake it in an oven, then beat it to a powder, mix it again into a dough, bake it, and thus repeat it the third time; whereupon put thoſe cakes in wine, and it will inſtantly begin to grow ſour.

3. Soak the beſt tartar nine or ten days in good vinegar, then dry it in the ſun, when dry ſoak it again for ten days in vinegar, and being dry'd, beat it to a fine powder; of this take as much as will lay on the point of a knife, mix'd with a quart of wine, and it will in a little while turn it to vinegar.

4. Take one pound of raiſins, clear them from the ſtalks, and put them into a glazed pan or pot, in a quart of good vinegar, let them ſoak over night on hot aſhes, boil them in the morning a little, then take it off the fire, let it ſtand and cool of itſelf; ſtrain it and keep it for uſe.

5. Take iron or ſteel, quench it five or ſix times in vinegar, and it will become very ſharp.

6. Salt, pepper and leaven put together into wine and ſtirr'd about will ſoon turn it into vinegar.

To prepare a fixed Salt out of Vegetables.

TAKE herbs, what quantity you pleaſe (thoſe that ſhoot up in long ſtalks are the beſt for this purpoſe); burn them to aſhes in an open place, or upon the hearth; take off the aſhes and put as much as you will into a kettle; pour water upon it, and let it boil; then filtre the lee through a linnen rag, and pour freſh water on the remaining aſhes; boil and filtre it as before, and this continue to repeat till you can perceive no ſharpneſs in the aſhes.

Then pour all the lee into one kettle, and boil it over a fierce fire, till the ſalt remains dry at the bottom; of this take

12 ounces, yellow brimſtone two ounces, both well pulveriz'd, and mix'd together; put ſome of this into the iron caldron which is made pretty hot, and in which you before boil'd your ſalt; let the brimſtone burn gently away, taking care not to make the caldron too hot, leſt it ſhould occaſion the ſalt to melt, which to prevent ſtir the matter continually, whilſt the ſulphur is burning, with a ſpatula: when you find the ſulphur conſumed, put what remains upon a clean paper; put more of the mixture into the caldron and proceed as before, till you have burn'd all the ſulphur; then put them with ſulphur ſalt calcined all together into the caldron, and make it red hot; ſo that if there ſhould be any ſulphur left, it may be conſumed, and the ſalt become of a whitiſh gray colour; then take it off the fire, pour, whilſt it is hot, cold water to it, and it will diſſolve it immediately; then filtre it through a brown paſteboard or paper; if the ſulphur is all clear from it, the ſolution will be of a whitiſh yellow, if not it will either be green or of an iron gray.

This filtrated ſolution pour again into the clean caldron, ſet it upon a wind-furnace, draw it off dry, and give it ſo long a fire till the ſalt is red hot; when ſo, pour again quickly ſome water upon it, and it will diſſolve; repeat this, till by taking a little of the ſolution into a ſpoon, and holding it in the light, you ſee not the leaſt film or ſpeck on the ſurface thereof; but if you do, take it off the fire, and filtrate it into a clean cucurbit, ſet it in warm ſand, and let it evaporate, without giving it the leaſt motion, and in two or three days according to the quantity of the ſalt, it will ſhoot into fine cryſtals, and when it has done chryſtalliſing, there ſettles a cryſtalline cruſt upon the ſurface; let it cool, take out the cryſtal, and the remaining liquor place again upon the warm ſand, to evaporate and ſhoot into cryſtals.

You muſt obſerve not to be too ſparing with the water which you pour upon the red hot ſalt, before you filtre it, elſe the ſalt would ſettle at the bottom, and ſhoot no cryſtals.

If it ſhould happen, that in burning the brimſtone your ſalt ſhould diſſolve; then take it off the fire, let it cool, and beat it in a mortar; and after you have diſſolv'd and calcin'd it, burn it once again with the ſulphur, and then uſe it with the reſt.

The burn'd aſhes of green herbs, or of ſuch as are not too dry, yield more fix'd ſalt than ſuch as are dry'd.

Soap of Naples.

TAKE the ſuit of a cow or calf, and put it into an earthen veſſel with a cloſe cover: melt and ſtrain it through a coarſe cloth, then pour upon it with diſcretion the firſt and ſtrongeſt ſoapmakers lee; ſtir it and ſet it in the ſun, and let it ſtand all night in the open air, only take heed to keep it from being wetted: when you perceive it ſome-what dry, put ſome of the ſecond and third ſort of lee to it; then let it ſtand, and if by rubbing a little on the palm of your hand, you ſee it froth, it is a ſign that it is done to perfection.

Balls to take out Spots of Oil or Greeſe.

TAKE ſoft ſoap; incorporate it with the aſhes of vines finely ſifted, of one as much as the other; then add to it roach allum burned, and tartar, finely powder'd; ſtir all well together, and form it into balls, with which you may take ſpots out of any garment.

PART X.

Several Secrets relating to MARBLE.

How to ſtain Marble that is White, and paint upon it with various Colours; which may penetrate into the Stone ſo as to bear Poliſhing.

TAKE of aqua fortis two ounces, ſal-armoniac one ounce, of high rectified ſpirit of wine four drams; then take ſome gold, make of it an amalgama with mercury or quickſilver, let the mercury evaporate, and the gold will remain at the bottom of your crucible like a brown powder or calx: diſſolve this in aqua regis, and evaporate it till it is of a yellow colour; then pour on the ſal-armoniac and the ſpirit of wine, and when diſſolv'd, evaporate the ſpirit again, and there remains a bright gold colour.

Calcine the ſilver in a phial, and then let the aqua fortis evaporate till you have a sky colour, which take off and preſerve in a clean phial, keeping the reſt in a warm ſand to evaporate, and you will have a deep blue, which you alſo preſerve, the remains will, by more evaporating, turn into black.

By mixing theſe colours you may produce ſeveral others; wherewith you may paint or ſtain what figures you pleaſe; and the more you repeat laying on this colour, the deeper they will penetrate into the ſtone, and the ſtronger they will repreſent themſelves thereon. After you have finiſhed your ſtaining, you may poliſh it like plain white marble, and then you will have the colours appear in their full luſture.

Marble may alſo be ſtained with colours which have been drawn from vegetables, with ſpirits, ſal-armoniac, or urine; but although they penetrate a good way into the marble, they will, on account of their volatile nature, be of no long duration: the red colour in this proceſs is made of dragon's-blood, tempered with urine of horſes, hogs, or dogs; the blue is treated in the ſame manner, for which they uſe blue verditer: the purple colour is drawn from cochineal, mix'd with any of the ſaid urine; ſome inſtead of urine, uſe ſpirit of wine.

To imitate Marble.

TAKE plaſter of paris, quick-lime, ſalt, ox-blood, ſtones of different colours, alſo pieces of glaſs, all beat to powder, and mixt up to the conſiſtence of a paſte, with vinegar, beer or ſour milk, and then lay it into tables, pillars, or what you will; let it ſtand ſo long till it is thoroughly dry; then rub it firſt with a pumice, and poliſh it with tripoli, giving it the finiſhing ſtroke with rubbing it over with leather and oil. *Or,*

WITH fine pulveriz'd plaſter of paris, and ſize of parchment, make a paſte, mix with it as many colours as you pleaſe, ſpread it with a trowel over a board, and when dry, proceed as before.

To paint on Wood in imitation of Marble.

FIRST lay a ground (repeating it ſeven or eight times) with white, as you have been directed in the method of gilding on wood; then marble it with what colours you pleaſe, after you have tempered them with the white of eggs, and mix'd a little ſaffron water therewith. If you are not uſed to marbling with a pencil, you may pour one ſort of your colour here and there a little, upon the white prepared table, then holding and turning it ſhelving, the colour will diſperſe all over the ground in variety of veins; then with another colour proceed in the ſame manner, and ſo with as many as you think proper, and it will anſwer your purpoſe: after it is dry, you may with a pencil give it a finiſhing by mending ſuch places as are faulty; then you may lay on a varniſh, and poliſh it in the beſt manner you can.

To

To imitate or counterfiet Agat.

TAKE of clarified turpentine as much as you will, boil it in an earthen pan with a little ſweet oil, ſo long 'till the turpentine be as thick as a dough, then pour it on a mould, and let it ſtand in the ſun for eight days; after this you may form it into what ſhape you pleaſe, and ſet it in a ſhade 'till it is quite hard and dry.

Others take the white of 18 eggs, beat well together: then they add to it 3 ounces of clear gum arabick, 1 ounce of almond-tree gum, beat to a palpable powder, and mix it with the white of eggs; when it is well diſſolv'd, they pour it into an earthen deep plate or diſh, and ſet it in the ſun, till it is a maſs, of that ſubſtance that you may form or make impreſſions with of any thing.

Others take the white of eggs, beat them clear, take off the ſcum with a clean ſpunge, then colour it with a tincture of ſaffron, and pour it into a hog's bladder; boil it hard on a ſlow fire, hang after this the bladder in the air, when it hardens ſo that you may form what you will, and ſet it in the ſhade till it has the hardneſs of a ſtone.

To imitate a Jaſpis.

TAKE quick-lime, mix it with the white of eggs, and roll it up in balls, this will ſerve for the white; for red mix along with it lake or vermillion; for blue add indigo or *Pruſſian* blue: for green uſe verdigreaſe, and ſo on.

When you have made many different ſorts of coloured balls, to the conſiſtence of a dough, then flat them with a rolling-pin, as you would do pye-cruſt, lay them one upon another, and with a thin knife blade, cut it in long pieces, and mix them confuſedly in a mortar together; then with a trowel ſpread it over a table, pilaſters, *&c.* very ſmooth and even; when dry, pour boiling hot oil upon it, and ſpreading it all over, it will ſoak in; then ſet it in a ſhady place to dry.

You may if you will, mix your quick-lime and your colours with oil at firſt, and then there will be no occaſion to oil it afterwards.

How to clean Alabaſter or white Marble.

BEAT pumice ſtones to an impalpable powder, and mix it up with verjuice, let it ſtand thus for two hours; then dip in it a ſponge and rub the marble or alabaſter therewith; waſh it with a linnen cloth and freſh water, and dry it with clean linnen rags.

To Stain Alabaſter Images of all Sorts of Colours for this purpoſe.

TAKE quick-lime, allum, ſal-armoniac, of each 1 lb. pour upon it, after you have pounded and mixt it, of ſtale urin of a boy 1 lb. and ſpirit of wine 1 lb. put it into a limbeck, and a good deal of the ſpirit of wine and of the urin will diſtill from it without fire; and when you perceive that it comes but low, put a ſlow fire under it to diſtill the reſt of the ſpirit from it. When done, put it up in a vial and ſtop it cloſe. This ſpirit extracts from all the drugs their natural colour, as out of farnembuck a fine red; of orlean a fine yellow; of turneſol a purple; out of cochineil a fine crimſon; of lackmoſe a fine blew; of verdegreaſe a pleaſant green; of curcumi an orange colour, &c.

To imitate Marble in Brimſtone.

TO do this, you muſt provide yourſelf with a flat and ſmooth piece of marble, on which make a border or wall, to encompaſs either a ſquare or oval table, which you may do either with wax or clay. When this is done, provide and have in readineſs ſeveral ſorts of colours, each ſeparately reduced to a fine powder; as for example; white lead, vermillion, lake, orpiment, maſticot, ſmalt, *Pruſſian* blue, and ſuch like colours. After you are provided with them, then melt on a ſlow fire in ſeveral glazed pipkins ſome brimſtone; put in each one particular ſort of colour, and ſtir it well together; then having before oiled the marble all over within the wall, drop with one colour quickly ſpots upon it, of larger and leſs ſizes; then take another colour and do as before, and ſo on, till the ſtone is covered with ſpots of all the colours you deſign to uſe; then you muſt conclude what colour the maſs or ground of your table is to be; if you would have it of a grey colour, then take fine ſifted aſhes, and mix it up with melted brimſtone, or if red, with *Engliſh* red oaker; if white, with white-lead; if black, with lamp-black or ivory black. Your brimſtone for the ground muſt be pretty hot, ſo that the drops upon the ſtone may unite and incorporate together; when you have poured your ground even all over, then, if you will, put a thin wainſcot board upon it; this muſt be done whilſt the brimſtone is hot, making alſo the board hot, which muſt be thoroughly dry, in order to cauſe the brimſtone to ſtick the better to it, and when it is cold, poliſh it with oil and a cloth, and it will look very beautiful.

To imitate a Porphyry on Glaſs.

TAKE red oaker and lake, grind them with water of gum tragacanth; then ſprinkle with a bruſh or feather, the glaſs all over with that colour; when dry take brown red, or if that is too red, add ſome umber, or ſoot to it, mix it up with gum tragacanth to the conſiſtence of a paſte, and lay it on the glaſs, over the ſprinkled colours, as thick as you pleaſe; then let it dry. If you proceed after the ſame manner on a poliſh'd marble, or any other ſtone that's flat and ſmooth, and lay a thick coat of the brown red on the ſpots of lake, letting it dry in the ſhade, and then poliſh it, you will have a beautiful imitation of porphyry without the glaſs; obſerve to anoint the ſtone firſt with a little oil, before you ſprinkle your lake, ſo as to come off eaſy when the work is done.

How to make Fret-work Cielings.

TAKE pebbles, pound them fine in an iron mortar, ſearce them through a fine hair ſieve, then take of powdered lime one part, of the pebble powder two parts, and mix them together with water; then take the mixture, and lay it all over the cieling, very ſmooth; carve then on it what you pleaſe, or lay to it ſome ornament with moulds which are cut in ſmooth wood, or caſt in lead; fill the mould with the mixture, preſs it to the cieling, and it will ſtick and come clean out of the mould; let it dry; when dry, and you perceive that it it is not every where of a good white, then with a clean pencil bruſh and clear water ſtrike it over, and it whitens of itſelf. It will in time grow as hard as ſtone.

PART XI.

Plain Inſtructions for Limning and Colouring PRINTS, MAPS, *&c.* with Water-colours, and Drawing in PERSPECTIVE.

Of the Colours generally uſed in that Art.

For White uſe.
- 1 White Lead
- 2 Flake White
- 3 Muſſel Silver

Blue
- 1 Indigo
- 2 Blue Lake
- 3 Blue Verditer
- 4 Smalt
- 5 Ultramarine
- 6 Latmus
- 7 Pruſſian Blue

Red
- 1 Vermillion
- 2 Red Lead
- 3 Red Oaker
- 4 Lake
- 5 Carmine

Green
- 1 Sap Green
- 2 Verdigreaſe
- 3 Terra Verde

Yellow
- 1 Yellow Oaker
- 2 Maſticot
- 3 Pale Maſticot
- 4 Dutch Pink
- 5 Gamboge
- 6 Naples Yellow
- 7 Shell Gold

Brown
- 1 Brown Oaker
- 2 Chimney Soot of a Wood Fire
- 3 Cologn Earth
- 4 Umber

Black
- 1 Lamp Black
- 2 Ivory Black
- 3 Sea-coal Black
- 4 Indian Ink.

Out of theſe colours you may temper all the reſt which you work may require.

Som

Some colours are to be waſhed and ground, as for inſtance, 1 White lead. 2 Brown oaker. 3 Dutch pink. 4 Umber. 5 Cologne earth. 6 Ivory black.

Some are only to be waſhed, which are, 1 Red lead. 2 Maſticot. 3 Blue biſe. 4 Smalt. 5 Ultramarine. 6 Vermillion.

Others are only ſteep'd in fair water, as, 1 Gamboge. 2 French yellow, to which you muſt add a little allum. 3 Sap green. 4 Blue Lake, and 5 Latmus.

And others again are only ground, *viz.* 1 Flake white. 2 Indigo. 3 Lake. 4 Diſtill'd verdigreaſe.

Grind all your colours with fair water on a hard ſtone, or on a piece of looking glaſs, which fix with white pitch and roſin upon a flat board, having alſo a muller of that kind.

Of the colours (after you have ground them very fine) you may take as much as will ſerve your preſent occaſion, and temper them in a gallipot or ſhell with gum-water, in which you have alſo diſſolved ſome ſugar candy. You muſt obſerve, that colours which are very dry, require a ſtronger gum water, in others it muſt be uſed very ſparingly.

If your colours won't ſtick, or the paper or print be greaſy, mix a very little ear-wax, or a little drop of fiſh or ox-gall amongſt your colour; you may dry your fiſh or ox-gall and dilute it when you have occaſion for it, with a little brandy. If your paper or print ſinks, then with clean ſize and a ſponge wipe it over, after you have faſtened the edges round upon a board, and let it dry.

You ſhould be provided always with vials containing the following liquids, which are very neceſſary and uſeful in painting or colouring with water-colours.

1. A vial with water in which allum has been diſſolved. This you uſe in wiping over your table, parchment, or paper, before you begin to lay on your colours; it will cauſe them to lay ſmooth, and with a greater luſtre.

2. A vial with lime water; you diſſolve or ſlacken ſome quick lime in fair water, then take the water from off the ſettled lime, and put it up for uſe; this is of great uſe in tempering of ſap-green and litmus, which colours being apt to turn yellow, are preſerv'd thereby.

3. Gum-water is made of gum-arabic diſſolv'd in fair water; if you add a little white ſugar-candy to it, that will keep the colours from cracking and flying off the parchment or paper.

4. Ox-gall, or the galls of eels, boil'd up in a little water, and ſcum'd, then put up in a vial; this is of great uſe in painting of water colours, where the parchment or paper happens to be greaſy, by only touching the point of your pencil to wet it therewith, and to temper it with your colour.

5. White wine vinegar; this is of uſe in grinding of diſtill'd verdigreaſe, as preſerving that colour from changing upon the yellow.

6. A little vial of ſpirits of hartſhorn, a little drop whereof mixt among the carmine adds to the beauty thereof.

You muſt chuſe pencils of ſeveral ſizes, agreeable to the work you are to uſe them for; as for laying on a ground, a sky or clouds, chuſe a larger ſize than thoſe that you uſe for drapery, trees, *&c.* wherein you muſt follow your own reaſon: thoſe pencils of which the hairs, after you have wetted them between your lips, and turned them upon your hand, keep cloſe together, are the beſt.

To paint or colour a clear Sky.

TAKE clear blue verditer, mix'd with a little white; with this begin at the top of your landskip or picture, and having laid on the blue for ſome ſpace, break it with a little lake or purple, working it with a clean pencil, one colour imperceptibly into another; apply more white and maſticot, in order to make it fainter and fainter towards the horizon, working all the while the colours imperceptibly one into another from the horizon to the blue sky; after which you may lay ſome ſtronger ſtrokes of purple over the light, ſo as to make them appear like clouds at a diſtance.

For a firery red sky, uſe read lead and a little white inſtead of the purple ſtreaks or clouds, working them according to art imperceptibly one into another.

Clouds you are to lay on with white, and black, ſometimes mix a little purple therewith; but the beſt and ſureſt direction you can have is from nature herſelf.

To lay a Ground for Walls of Chambers, Halls, &c.

YOU muſt uſe for a common wall, which is of a reddiſh hue, brown, red, and white, and temper your colour according as it is old or new; ſhade it with brown red, only mix'd with a little biſtre or ſoot.

Other walls lay on with black and white, and ſhade it with the ſame colours; ſometimes mix a little purple with it, and then you ſhade it with black and lake.

For wainſcoting, that is embelliſhed with carv'd mouldings and figures, you muſt uſe one colour, for both the plain and the carved work, ſhading and heightening it with judgment and care.

To paint a fore ground, in imitation of ſand or clay, lay on the darker parts with brown oaker; to what is in their diſtance, add a little white, and ſo on in proportion; ſhading it with brown oaker, and the ſtrong ſhades with ſoot.

Of Carnation or Fleſh-Colour.

IN a carnation or fleſh colour, uſe for young women and children flake white, burnt oaker, and a little vermillion: ſome add a little lake, but that muſt be but ſparingly: having laid on the colour for the carnation, you ſhade the lips, cheeks, chin, knees, and toes, with fine lake and vermillion, and the naked parts, with ſea coal and a little lake, or brown red, or with brown oaker and lake, or elſe with indian ink or lake; for a browniſh complexion, mix a little brown oaker among the carnation colour.

Some artiſts lay the dead colouring of the carnation for young women on with white, then ſhade it with paper black, and bring in the carnation colour where it is requir'd. The

Paper-Black

Is made in the following manner; Take the paper in which the leaves of gold have lain, burn them quick one after another, and let them drop into a baſon of clean water; then take them out and grind them on a ſtone to a fine paſte, form it into little tents, and let it dry; when you uſe it temper it with gum water as you ſee meet.

For ancient people, uſe vermillion, brown oaker and white, ſhade it with biſtre and lake.

A dead corps of a young perſon paint with flake white, brown oaker and a little indigo, or ſea coal, and ſhade it with biſtre or ſea coal.

For an old dead corps leave out the indigo, but ſhade it as before.

For dead bones, take white lead mix'd with a little bitre or chimny ſoot; with which you ſhade it and highten it with white lead.

For the hair of young women and children lay them with light oaker, ſhade them with deep oaker, and highten them with maſticot and white.

Grey hair lay on with black and white; ſhade them with black and heighten them with white; and thus proceed in painting any other colour'd hair.

Drops of blood lay on with red lead, ſhade it behind where the light falls with carmine and lake.

Trees, are laid on, ſome white, black, and biſtre, ſhaded with brown oaker, and heightened with the ſame colour, with more white in it. Thoſe that ſtand at a diſtance, are laid on with indigo blue, brown oaker and white, and ſhaded with indigo and brown oaker. Thoſe that are further diſtant lay on faint, and ſhadow them but ſlightly; which order you muſt obſerve in colouring of ſhips, houſes, and other buildings.

In thatch'd houſes paint the thatch or ſtraw, when new, with *Dutch* pink, and ſhade it with brown-oaker, and to heighten the ſtraw uſe maſticot and white. Old ſtraw lay on with brown-oaker, ſometimes mix'd with black and white; heighten the ſtraw with brown oaker, and white.

In colouring cities, caſtles, or ruins, you muſt obſerve nature, for no rules can well be given; however to give a little light to a young practitioner, it muſt be obſerved that thoſe houſes which lie neareſt the fore-ground are coloured with vermillion, white, and a little brown-oaker; ſhading it with that and ſome biſtre; the heightenings are done with vermillion and more white.

Houſes further diſtant, are laid on with lake and a little blue and white, ſhaded with blue and lake, and heighten'd with adding more white.

Such buildings as lie ſtill further, are laid on with a faint purple and a little blue, ſhaded ſoftly with blue, and heighten'd with white; and the further they are off, the fainter and ſlighter muſt be your colour.

Flames and ſmoak, are laid on with a pale yellow; ſhade the ſmoak with paper black, or ſoot; the flames ſhade with red lead or vermillion, and highten them with Naples yellow.

In colouring of rocks, hills, *&c*, that are at a great diſtance, obſerve the ſame rule. Such as lay nearer the fore ground, you are to imitate according to nature. Trees that are upon the fore-ground, you paint with ſeveral ſorts of greens, the better to diſtinguiſh one from the other; ſuch as are on diſtant hills, muſt be done with the ſame colour as the hills.

How to paint or colour Cattle.

HORSES of cheſnut colour, you are to lay on with brown red, ſhaded with brown red and black, and heighten it with brown red, white and yellow: the manes and tails of horſes you may make white, as alſo the lower part of their feet.

You are to lay one of an aſh-colour on with black and white, ſhade it with a bluiſh black, and heighten it with white.

Lay on a black horſe, with all black, ſhade it with a deep black, and heighten it with black and white.

Lay a white horſe on with white-lead, juſt tainted or broke with a little red; ſhade it with black and white, and heighten it with pure white.

Spotted horſes muſt be done according as nature directs; and by theſe directions you will govern yourſelf in painting or colouring any other ſort of cattle.

Lay ſheep on with white, broke with a little biſtre; uſe in the ſhadows a little black.

Lay on hogs or pigs with brown-oaker, and yellow-oaker, and ſhade it with biſtre

A bear is laid on with brown oaker, black and brown red, ſhaded with biſtre and black, and heighten'd with brown oaker and white.

A

A leopard is laid on with yellow oaker, and ſhaded with biſtre; the ſpots are laid on with biſtre and black; the mouth with black and white.

An Aſs is commonly of a grizly colour, and laid on with black and white, broke with a little oaker.

An elephant is laid on with black and white and a little biſtre.

A monkey is laid on with *Dutch* pink, biſtre, and black; the hair is heighted with maſticot, white, and a little biſtre; the paws muſt be ſhaded off with black and brown red, with a little white.

A hart is laid on with brown oaker and *Engliſh* red, and ſhaded on the back, and where it is requiſite, with biſtre and brown-red; a ſtreak of white muſt be below the neck, as alſo the belly and breaſt of a white colour.

A hare is laid on with brown oaker; which loſes itſelf by degrees into white under the belly; the back is ſhaded with biſtre, and the hair is heightened with oaker and white.

A rabbit is laid on with white, black, and biſtre, the belly is white; theſe creatures are of various colours, which may be imitated after nature.

Of Birds.

A Falcon is laid on with brown-oaker, black and white, ſhaded with a pale black; the feathers muſt be diſplay'd and ſhadow'd with black, the breaſt is white, the legs are laid on with yellow, and ſhaded with brown oaker and biſtre.

A turky cock or hen, is laid on with black and white, and ſhadded with black, working the colours lighter and lighter towards the belly, which muſt be all white; the legs are laid on with indigo and white, and ſhaded with blue; when they are irritated, the ſubſtance about their bill muſt be laid on with vermillion and lake, deepening it with ſtronger lake; otherwiſe when they are calm, that part is a little upon the purple

A ſwan is laid on with white, with a little biſtre, and heighten'd, where the feathers ſeem to riſe, with pure white: the feet are blackiſh, and the bill red, with a black riſing at the upper end.

Pigeons,

Pidgeons, drakes, hens, *&c.* are of ſo many various colours, that there would be no end to give proper leſſons for every one, and thus it is with many other birds, which an artiſt ought to copy after nature.

Of Fruit.

APPLES are laid on with fine maſticot mix'd with a little verdigreaſe, or a little white, french-berry yellow and verdigreaſe; ſhade it with brown-oaker and verdigreaſe, or lake; heighten it with maſticot and white, and the ſtrongeſt light with white alone; but you muſt regulate yourſelf according to the colour of the apples as well as pears.

Cherries are laid on with vermillion and lake ſhaded with pure lake, and heightened with vermillion, or vermillion and a little white.

White-heart charries, are laid on in the middle with vermillion, lake and white, working it to a yellow towards the ſtalk, and with lake towards the top.

Morello's are laid on with lake and a little black, ſhadow'd with black, and heightened with vermillion, lake and black: this muſt be intermix'd, that the colours may ſeem all of one piece.

Mulberries are laid on with lake and biſtre, ſhadow'd with black, and heightened with vermillion; on the higheſt lights give little dots with lake and white.

Strawberries are laid on with a yellowiſh white, then ſhaded with lake and vermillion; and highten the knobs with white and vermillion.

Grapes, the black ones are laid on with purple, ſhaded with blue verditer and indigo, heightened with white.

The white grapes are laid on with pale verdigreaſe, a little maſticot and white; the blue bloom is very gently, with a blunt pencil touch'd with blue verditer.

Peaches and apricocks are laid on with white maſticot, or french-berry yellow and white, ſhaded with red-oaker and yellow; if there muſt be a bloom upon them, do it with lake, and heighten it with white as you do the grapes; ſome are of a greener colour than others, wherein you are to copy nature as it lies before you.

Radiſhes and Turnips, are laid on with white, ſhaded with indian-ink, and at the top with lake; working it down faint into white towards the bottom. The top is laid on with verdigreaſe and ſap-green, ſhaded with ſap-green and indigo, and heightened with maſticot.

Carots are laid on with yellow-oaker, and if they are of a high colour it is mix'd with red-lead; they are ſhaded with brown-oaker, yellow-oaker and biſtre, and heightened with maſticot. For the reſt I direct the practitioner to nature.

Of Flowers.

ROSES are laid on with a pale carmine and white, ſhadow'd with carmine and leſs white and the deepeſt with carmine by itſelf; make the heart always darker than the reſt. The ſeed in full blown roſes is yellow.

Tulips are of various kinds, colours and ſhapes; it is impoſſible to give certain rules for colouring them.

Some are done with lake and carmine on white, mix'd together; others with purple, laid on with ultramarine, carmine and lake; ſometimes bluer and ſometimes redder; theſe colours muſt be ſtreaked according to nature. Thoſe of one colour, as yellow, red, *&c.* are laid on with ſuch colours, and if there appear any ſtreaks you muſt make your colour either lighter or darker, as nature directs.

Emonies are of ſeveral ſorts, ſome are laid on with lake and white and finiſhed with the ſame. Others with vermillion, and ſhadow'd with that colour, carmine and lake. Yellow ones are laid on with maſticot, ſhadow'd with that and vermillion, ſometimes with brown lake.

Red lillies are laid on with red lead, ſhaded with vermillion, and carmine.

The peony is laid on with lake and white, and ſhaded with the ſame colour and leſs white.

Yellow cowſlips are laid on with maſticot, and ſhaded with gumboge and umber. Purple ones are laid on with ultramarine, carmine and white, and ſhaded with leſs white.

Carnations and pinks are manag'd like emonies and tulips. Some pinks are of a pail fleſh-colour, ſtreaked with another that's a little higher,; this is done with vermillion, lake and white, and ſtreaked without white.

The blue hyacinth, is laid on with ultramarine and white, and ſhaded with leſs white.

The red or grideline, is laid on with lake and white, and a little ultramarine; and finiſh'd with leſs white.

The white ſort, is laid on with white, and ſhadow'd with black and white.

The crocus are of two ſorts, *viz.* yellow and purple. The yellow is laid on with maſticot, and ſhaded with gall-ſtone or gamboge; after which upon each leaf on the outſide are made three ſeparate ſtreaks with biſtre and lake. The purple ones are laid on with carmine, ultramarine and white, and finiſh'd with leſs white; the ſtreaks muſt be very dark on the outſide of the leaves. The ſeed of both is yellow.

Of Metals.

GOLD is laid on with red lead, ſaffron, and yellow oaker, ſhadow'd with lake and biſtre; in the deepeſt places with biſtre, lake and black, then heighten'd with ſhell-gold.

Silver is laid on with white, ſhadow'd with black and blue, and heightened with ſhell-ſilver.

Tin or pewter is done the ſame way, only it is laid on with white, mixt with a little indigo.

Iron is done like tin.

Braſs is done in the ſame manner as gold, only the ſhades muſt not be ſo ſtrong.

Copper is laid on with brown-red and white, ſhadow'd with brown-red, lake, and biſtre, heighten'd with brown red, and white.

Theſe directions will be ſufficient to guide young practitioners to nature, which is the beſt ſchool they can go to.

A ſhort Introduction to the Knowledge of DRAWING in PERSPECTIVE.

PERSPECTIVE repreſents things ſeen though a tranſparent medium, as air, water, clowds, glaſs, &c. and as nothing can be ſeen but through thoſe things, all we do ſee is call'd perſpective: We will ſuppoſe looking through a ſquare frame or a window in a room, at ſome convenient diſtance, into an open field, garden, ſtreet, &c. all what comes into our ſight in the compaſs of that frame is a perſpective view, and that view, draw'd in its due proportion, as it appears to our ſight, is call'd a perſpective picture or drawing: this is frequntly done, by the help of frames ſquar'd out with cord or cat-guts, which being plac'd in a window, or fix'd in any other place, the artiſt has as many ſquares rul'd on his paper, either larger or leſs than thoſe in the frame, and having fix'd in the table a round ſpectical frame on a ſtick before him, to look through, he will thereby preſerve the ſight of what he is copying. *See Plate* I. *fig.* 1.

This is done without the rules of art, but as I here propoſe to give novices in the art of drawing perſpective a little light into it, as far as it may be of ſome ſervice to them in drawing or painting, I ſhall, begin with the firſt principles thereof, and ſo proceed in an eaſy familiar method to make the ſtudy thereof plain, pleaſant, and expeditious; but firſt of all we muſt learn ſome terms of geometry, and the practice of them as will be neceſſary for drawing in perſpective, without which we can make but little progreſs in the purſuit of it.

To elevate Perpendicular Lines.

DRAW a line, which with your compaſs you divide in A, then from the ends of this line make the arches, which divide themſelves in B, then draw a line from A to B, If the

PLATE. I.

Fig. 2.

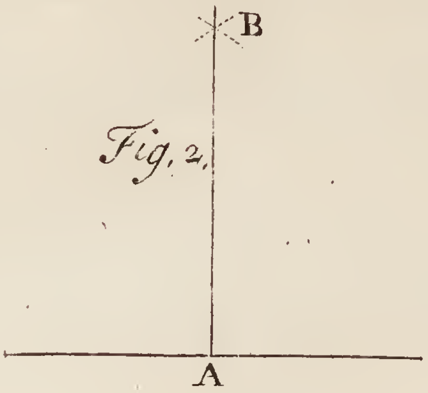


Fig. 1.

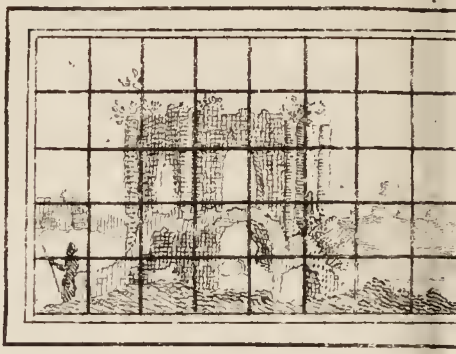


Fig. 4.

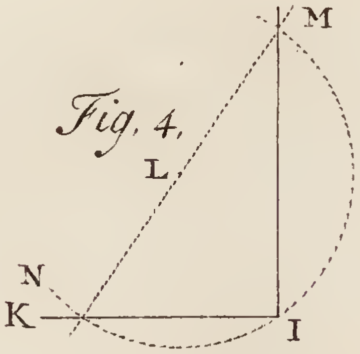


Fig. 3.

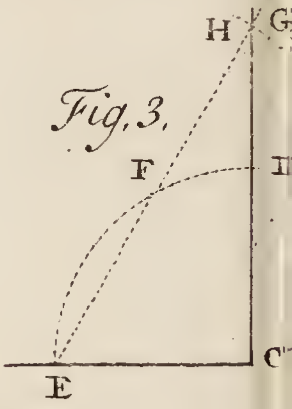


Fig 6

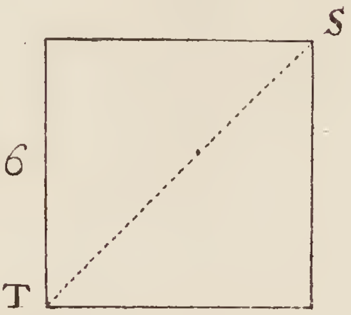


Fig. 5.

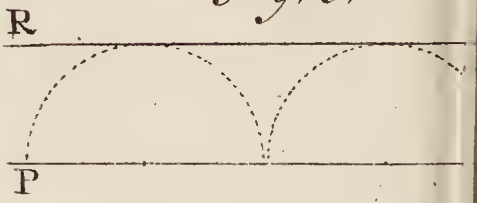


Fig. 8.

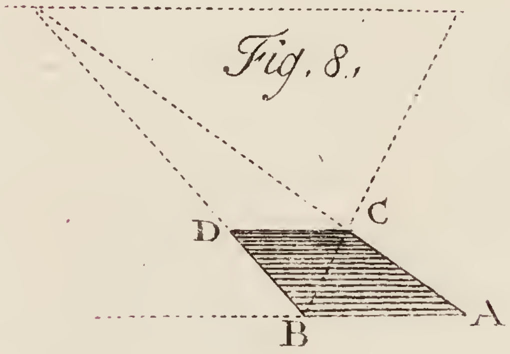


Fig. 7.

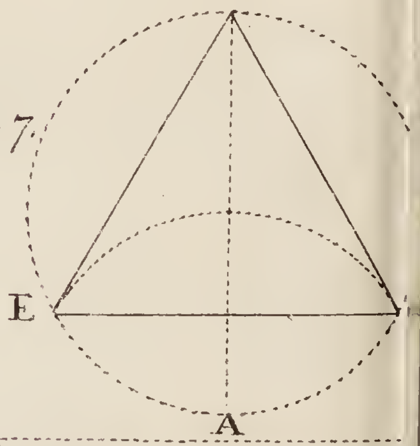
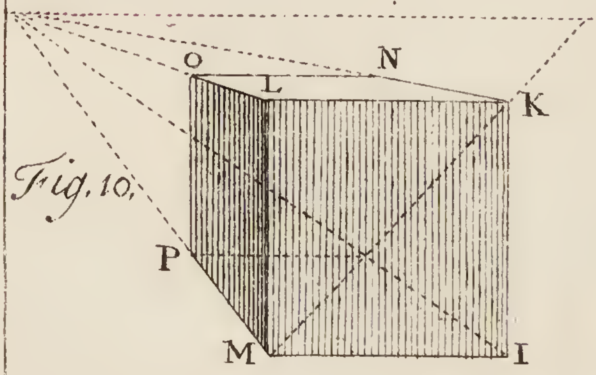
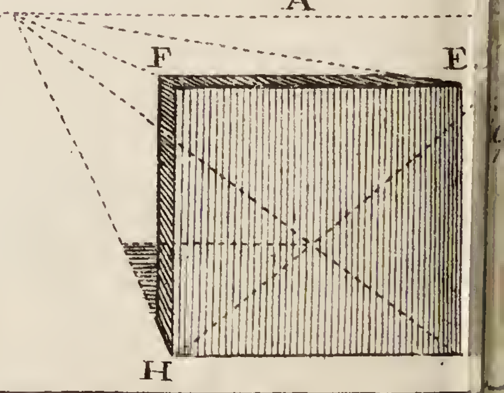


Fig. 10.





the perpendicular is to reach below the line given, you proceed in the ſame manner as above. *fig.* 2.

II. To elevate a perpendicular from the end of a line, may be done as the above, but where room is wanting you muſt place one leg of the compaſs at the point C, and with the other make the large portion of the circle D E, then ſet the compaſs open to the pint E, and with it divide the circle in F, then take half thereof, and add it to the former, which will give you the right angle to draw your perpendicular. Or you may with the ſame opening of the compaſs, without ſeeking the half meaſure make from F an arch G H, then laying the ruler at the points E F, you draw a line which ſhall divide that arch, there you elevate a line from C to G H *fig.* 3. *Or,*

Take a point at pleaſure over the line I K as L, then from that point make a circle which touches the point I, and will divide the line at M, then draw from M by the point L, to the circumference of the circle N, a line and M I will be the perpendicular. *fig.* 4.

III. To draw a parallel, you muſt do it over half rounds, which they muſt touch as O P, and are parallel to Q R, *fig* 5.

IV. The *Horizontal* line is no other but a paralel to the baſe, of which more hereafter.

V. The *Diagonal* line is drawn from one angle to another, as S. T. *fig.* 6.

VI. A *Triangle* is made by ſetting half the diameter at the point A and deſcribe the arch D E and draw a line D E, which will give the ſide of the Triangle. *See fig.* 7.

VII. *Ichnography* is the dimention of a platform or plane, upon which any Thing is to be raiſed, as A B C D, is the *Ichnography* or plane of a Square body. *See fig.* 8.

VIII. *Orthography*, deſcribes or repreſents the face or fore part of the object, as of a building, or a body of any thing oppoſit to one's Eye, ſo as E F G H, which is the *Orthography* of the forepart or front of a cube, or a building. *fig.* 9.

IX. *Scenography*, repreſents the object wholy elevated, with all its dimenſions of the front, ſides and top which may be ſeen; as I K L M N O P is a perfect cube. *See fig.* 10.

Of the Viſual Rays.

THE *Viſual Ray* is that from the object to the center of the eye; it is the ſtrongeſt of all others; it is this which divides the horizontal line and gives the point of ſight; If the object be a point then there is but one ray viſual, which is call'd centrical, *a b fig.* 1. *Pl.* II. If the object be a right line, as *a b*, the viſual rays make a triangle whereof the line *a b* is the baſe, and the two lines, *c d*, the rays on the outſide, which come from the eye *e*, and make the triangle *e*, *a*, *b*, *fig.* 2, If the object is a ſquare ſuperfive the viſual rays will make a pyramid. as *fig.* 3 and 4 of which *a b*, is the centrical and ſtrongeſt.

Of the Horizon.

THE horiſon in perſpective is a line, which gives the hight of our eye, and bears always the points of ſight and diſtance; or rather, a line which ſeparates the heaven from the earth, and which limits the ſight; for one can not ſee any thing above the horizon, which ſurpaſſes not the height of the eye: Thus a tree or mountain may have its top above the horizon, but the foot thereof is a good deal below it, as for example, A B are two pillars below the horizon, becauſe the eye is elevated. In the 2d they are equal with the horizon becauſe the eye is with them at an equal hight: In the 3d they are much above the horizon, becauſe the eye is lower then they. Thus, according to different ſtations of taking the horizon, the ſubject before us will be either higher or lower than the horizontal line. *See fig.* 4, 5, 6, *Plate* III.

PLATE. II.

Fig. 3.

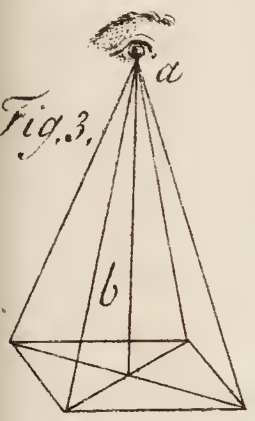


Fig 2

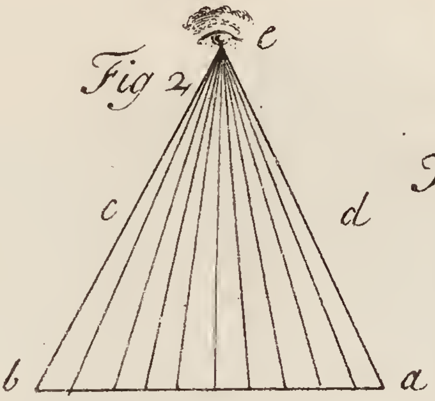
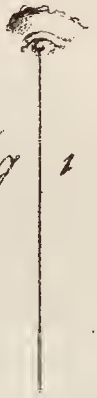


Fig 1



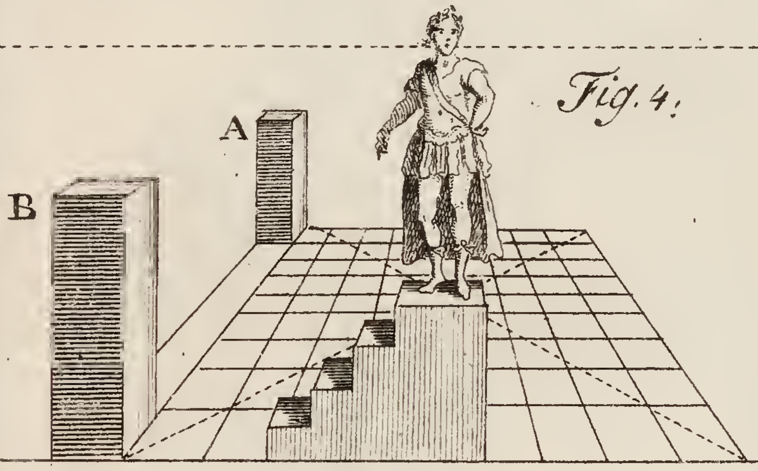


Fig. 4.

Fig 5

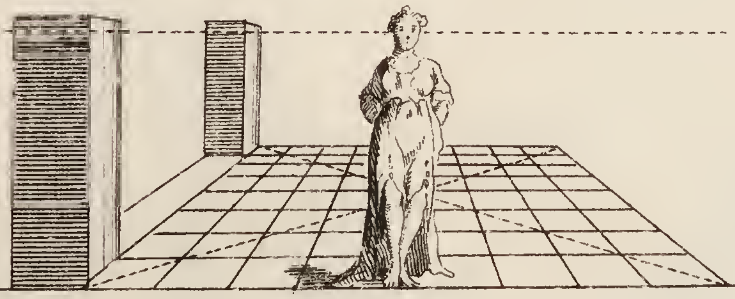


Fig. 6.

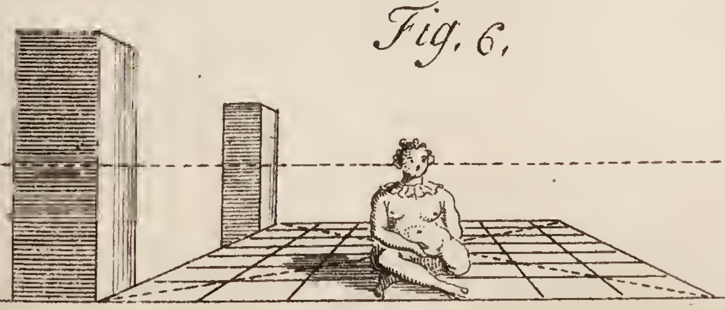


PLATE. III.

Fig 7

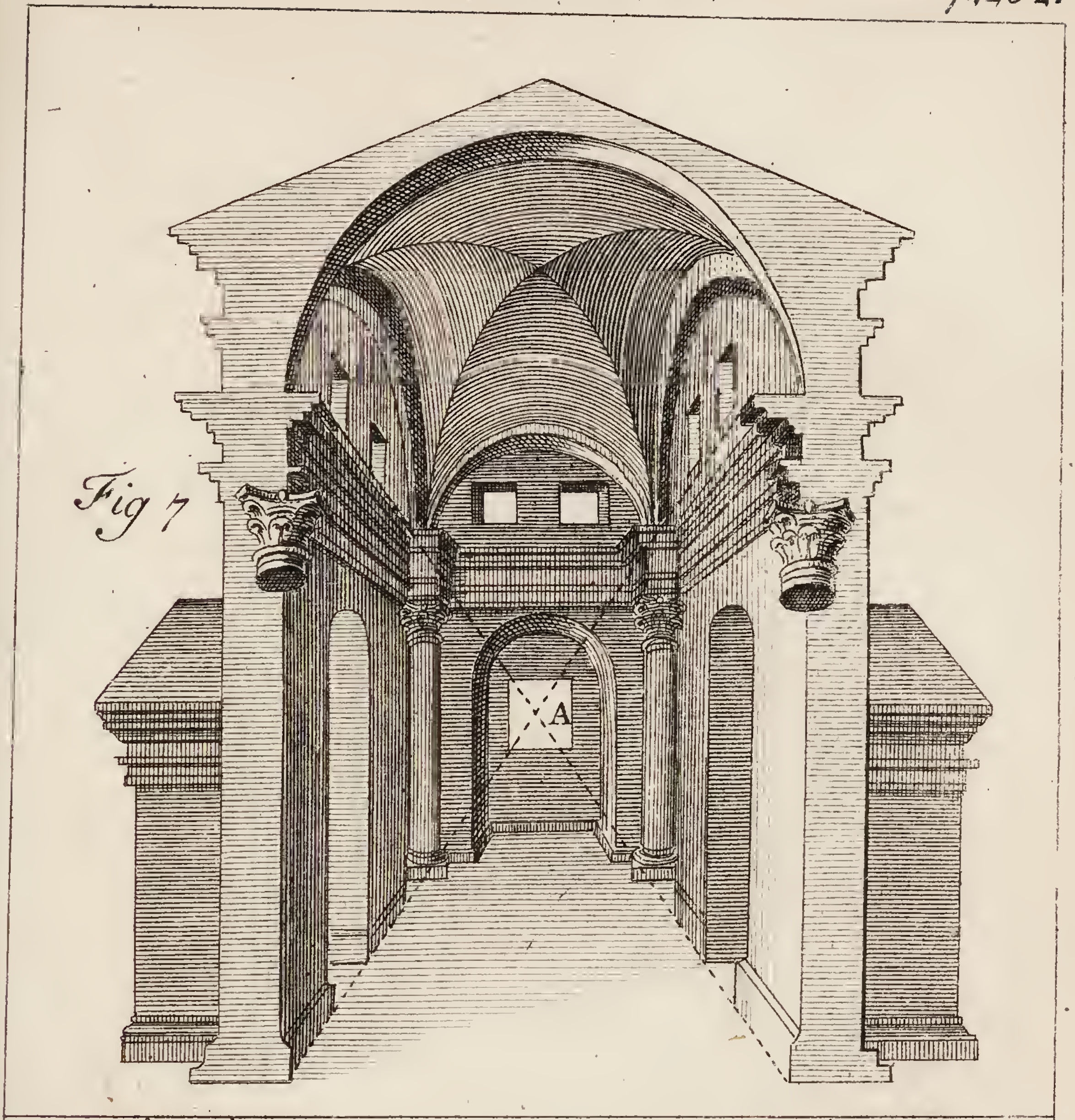


Fig. 8.

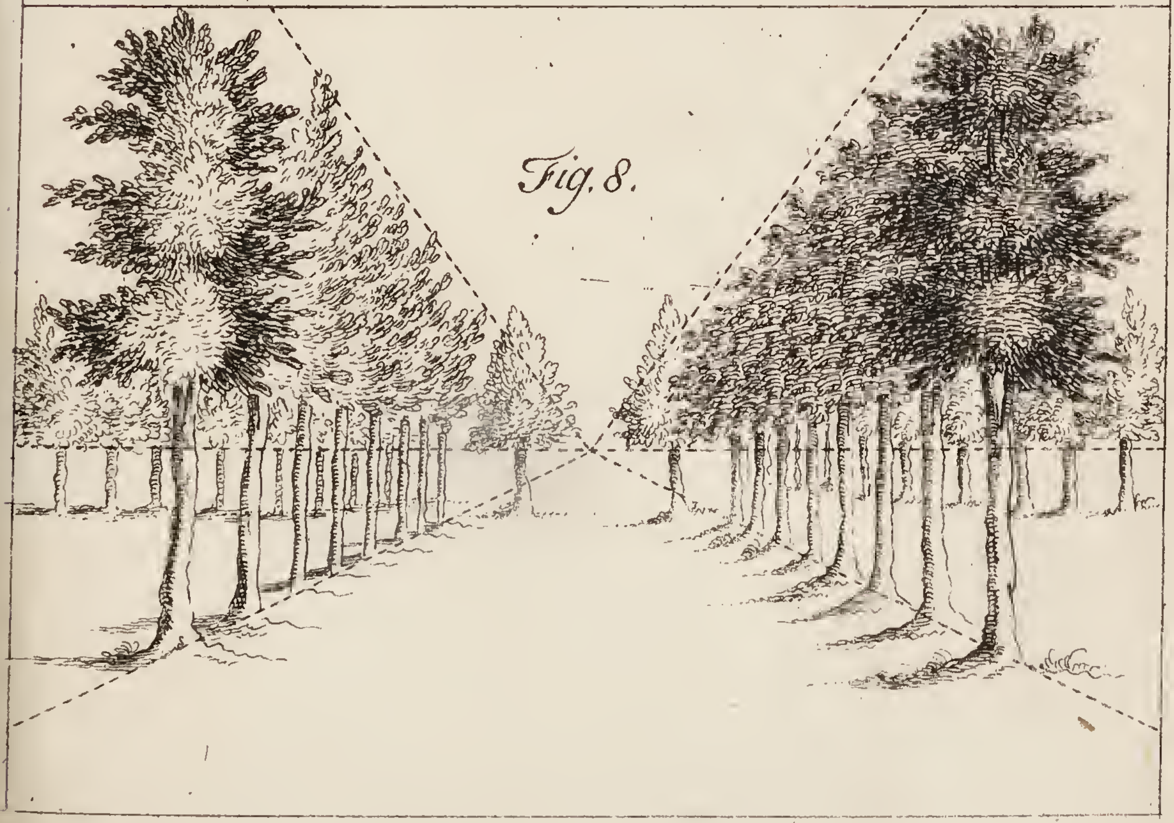


PLATE. IV.

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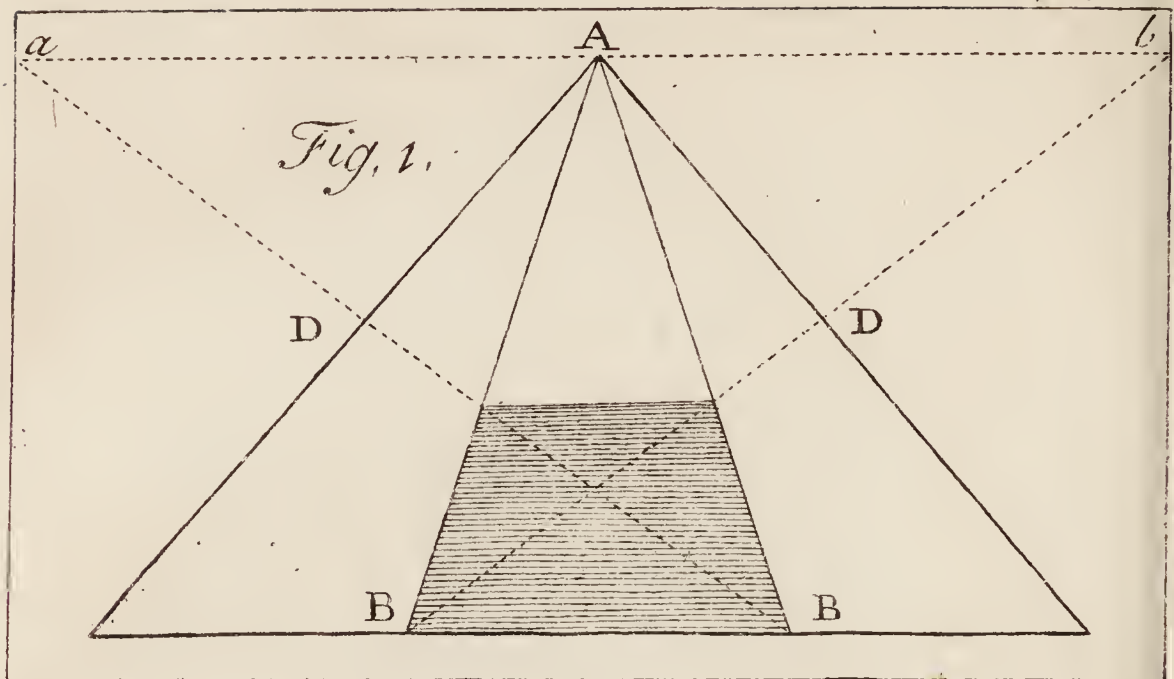


Fig. 1.

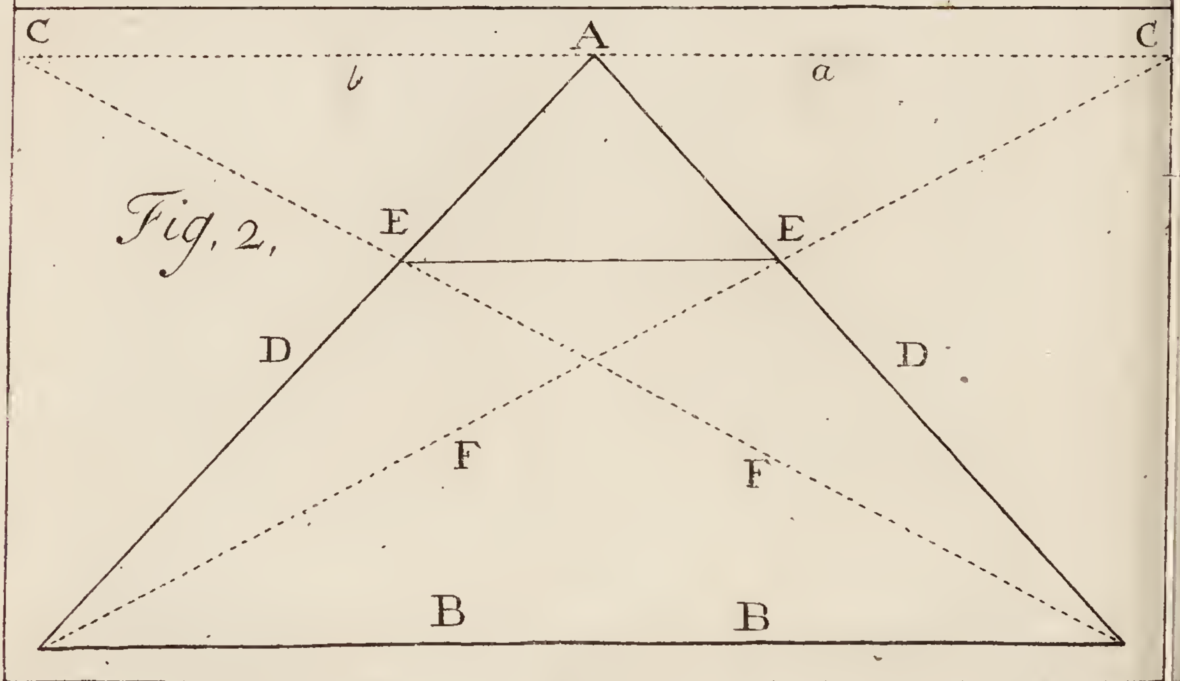


Fig. 2.

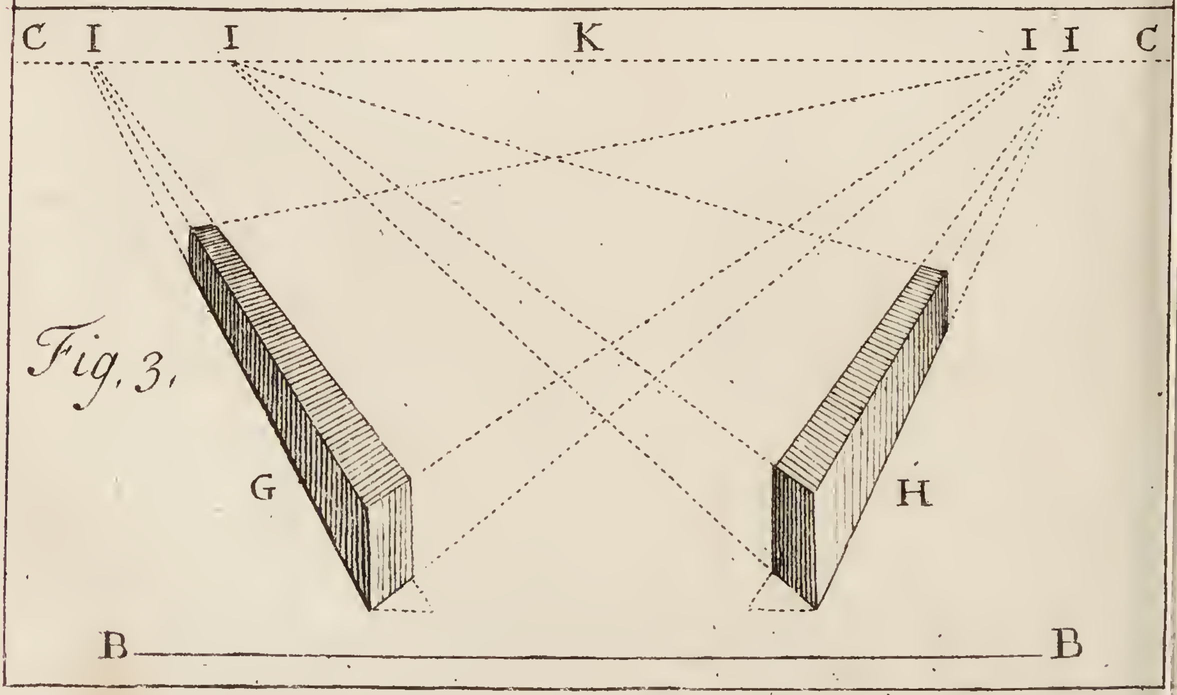


Fig. 3.

Of the Point of ſight; the Baſe: The Point of Diſtance and the Point Accidental.

THE *Point of ſight* A is that which makes the centrical ray on the horizontal line, *a b*, to which all the other viſual rays as D D art to join themſelves, *See Plate* IV. *fig.* 1.

The *Baſe* or *plane* B B, *fig.* 2. is the line on which the objects are to be; for every object has its own plane, which is always parallel to the horizon.

The *Point of* diſtance C C, are points ſet of an equal diſtance on each ſide of the point ſight, and is always within the horizontal line, as *a*, *b*, the horizontal line: A the point of ſight D D the viſual rays C C the points of Diſtance B B the plane or baſe, E E the abridgments of the ſquare of which D D are the ſides, F F the diagonal lines, which go to the points of diſtance C C. *fig.* 2. *Plate* IV.

Points accidental, are certain points, where the objects do end: theſe may be caſt negligently, becauſe they are not drawn to the point ocular, not to thoſe of diſtance, but meet each other in the horizontal line: for example: Two pieces of ſquare timber G and H make the points I I I I on the horizon, and go not to the point of ſight which is in K nor to the point of diſtance C C, theſe accidental points ſerve likewiſe for caſements, opening of doors, windows, tables, chairs, *&c. See plate* IV. *fig.* 3.

Of the Point, Direct or Front.

THIS is that when the object is whole before you, having neither one ſide nor the other in our view, but ſhews only the fore part or front when elevated: if it be not a polygone: for example, A D is wholly the front. ſo that one can ſee nothing of the ſides, A. B. D. C. the point of ſight being directly oppoſit to it cauſes the Diminution of both ſides: This is to be underſtood if the object is elevated; In a plane it ſhews all as you ſee. *fig.* 4. *Plate* IV.

The oblique point of ſight.

IS when the object is ſeen ſideways, which we ſee with the corner of the eye; the mean while the eye being always oppoſit the point of ſight, for example, the point of ſight being fix'd in F, and the viſual rays drawn, as uſual to that point the object will appear athwart, *fig.* 8. *Plate* IV.

Of the Diagonals and their Sections.

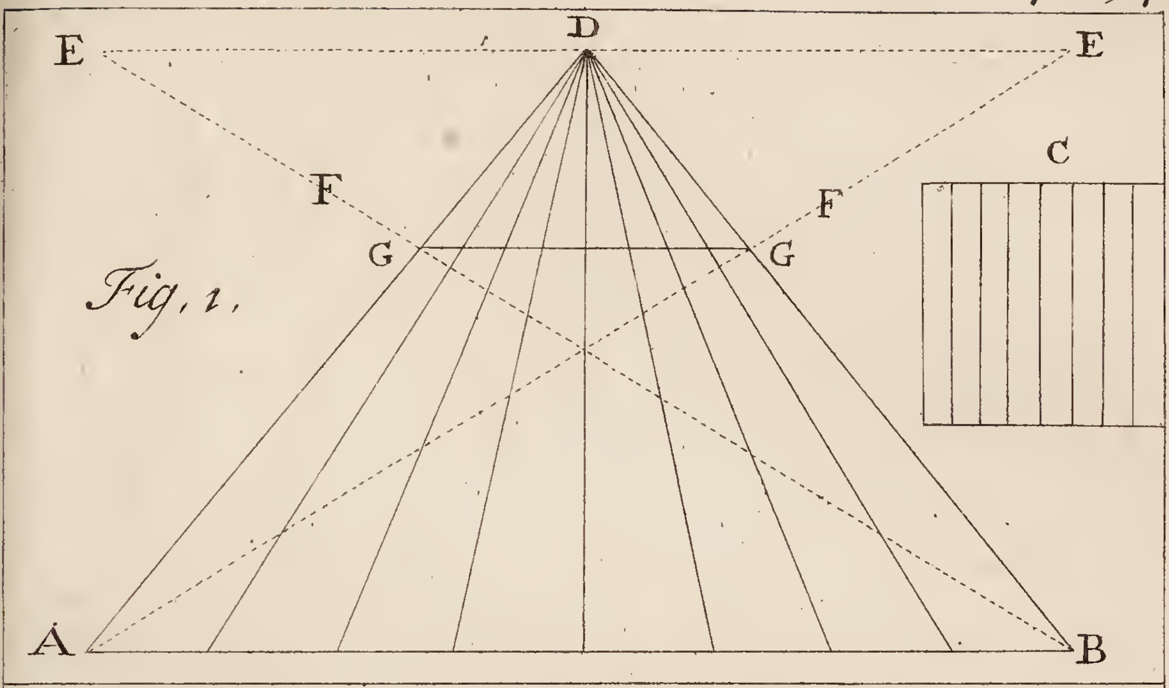
A *Geometrical Plane*, where the lines are perpendicular and parallel to the baſe, are always in perſpective to be drawn from the baſe to the point of ſight; for inſtance: ſuppoſe one gives a ſhorter or longer line for the perſpective than what is in the plane, as for inſtance, the long line A B, which muſt have the ſame number of diviſions as that of the plane C: from all which diviſions you draw lines to the point of ſight D, the diagonals F F are drawn for the dimentions of the ſquares, at the points of diſtance E E, as figure 2 plainly explains it: D the point of ſight: F F the diagonal lines: A B the baſe: E E the points of diſtance wherever the diagonal lines cut the rays which are drawn from the baſe to the point of ſight, there is the abridgment of the ſquare, as you plainly ſee G G, *fig.* 2. *Plate* V.

The *Diagonal Line* being drawn from each ſide, the plaine either neerer or further from the point of ſight, makes the abridgment either deeper or brings it cloſer.

Deep Sinking in Drawing of Perſpective.

THIS is done by means of drawing from each ſide of the baſe H H to the point of ſight I, and likewiſe from the ſame ſides to the point of diſtance K K, and where the latter divide the former as in L L that is the firſt abridgment: Then drawing from L L to the points of diſtance you will at M M find the 2d diſtance and ſo on, *ſee fig.* 3 and 4. *Plate* V. If the abridgment is to be oblique, you mark the point of ſight as has been taught before in *fig.* 8. *Plate* I. Thus you may draw any plane or pavement, garden plats, *&c.* as for example *fig.* 2. *Plate*

PLATE. VI.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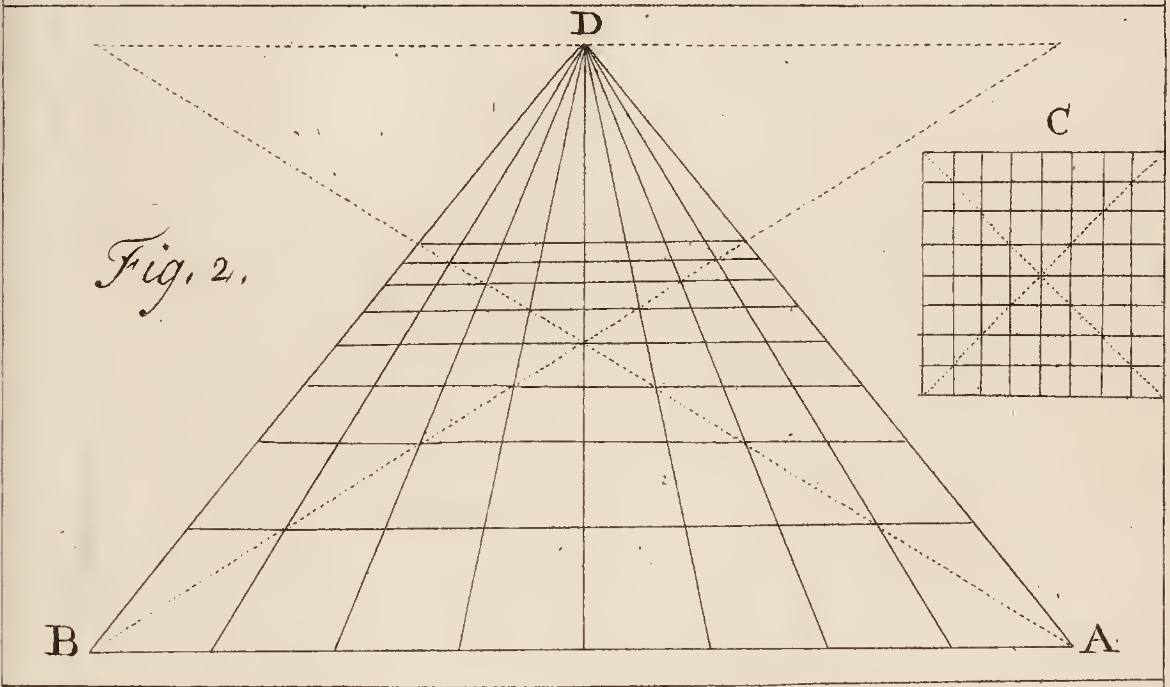


Fig. 2.

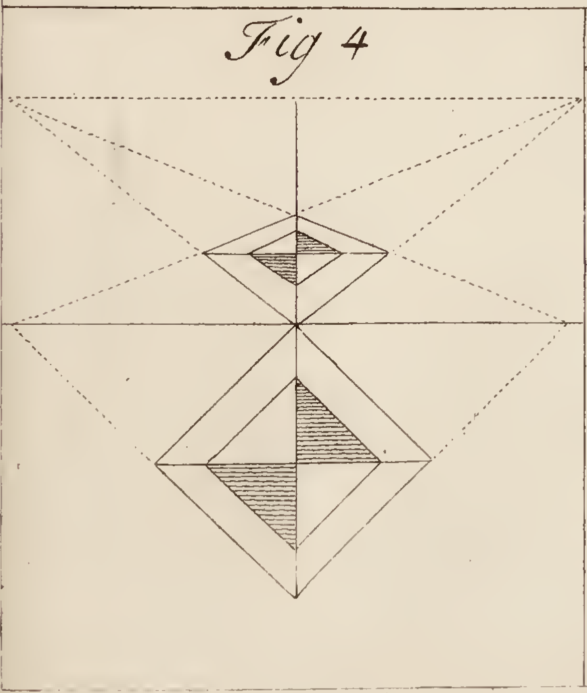


Fig 4

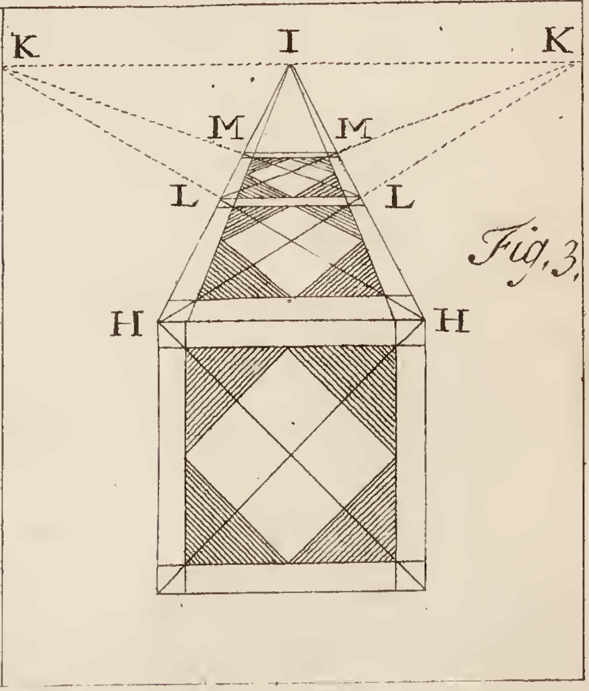


Fig. 3.

PLATE. VI.

Fig. 1.

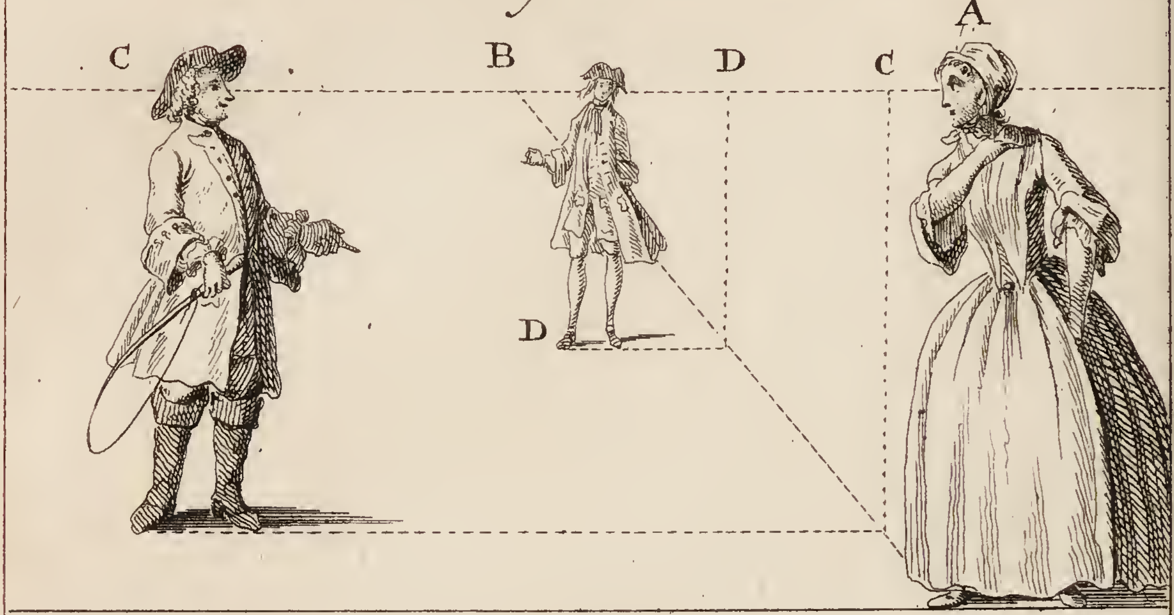


Fig. 2.

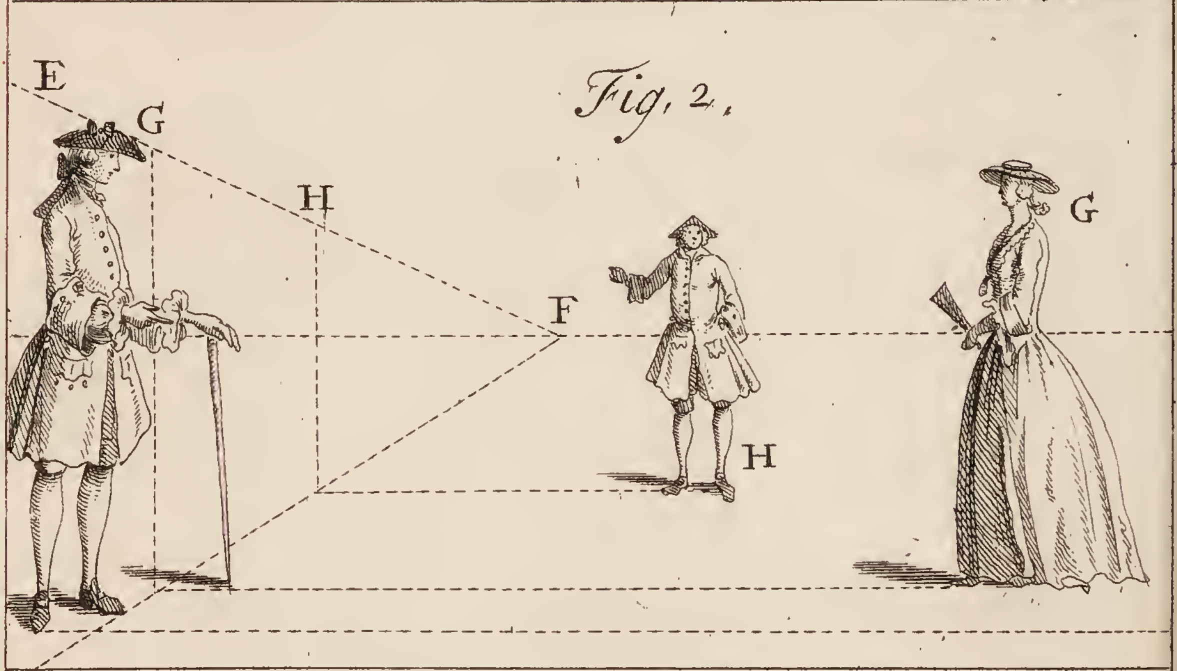


Fig. 3.

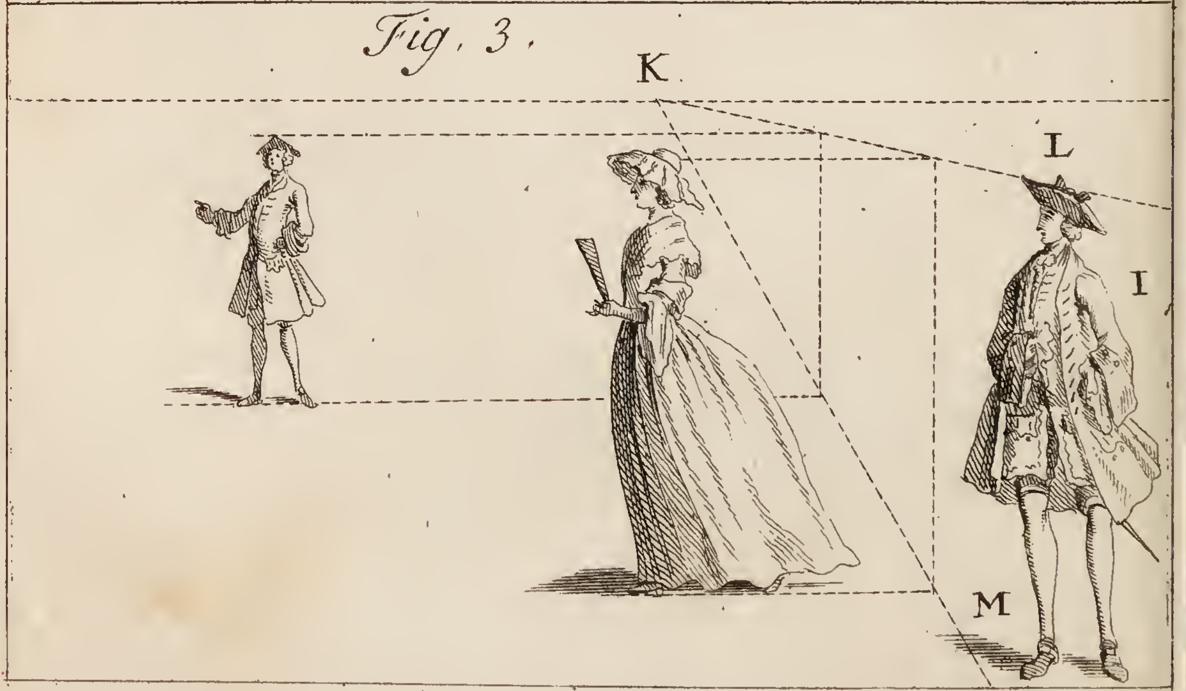


Plate V. you divide the baſe A B equal to the number of ſquares in the breadth of the pavement C, then draw from theſe diviſions the lines to the point of ſight D, after which draw the diagonal lines, and where they divide the lines to the point of ſight, there draw lines parallel to the baſe.

Of *Elevation in Perſpective or Scenography.*

THIS is the art of bringing any Thing elevated to a true proportion at the diſtance they are ſtanding; for which purpoſe you draw a line perpendicular on one ſide of the plane or baſe, on which you mark out the height of the firſt object, A and from that height you draw a line to the point of ſight, which you may place any where on the horizon, and whatever you draw perpendicular between them, will deſcribe the true proportion each elevation is to have, if they are of an equal height, if any thing appears above the horizon, that interferes with thoſe elevations of equal height, it muſt be drawn according to the Meaſure of its height, as you will be directed.

Hence it follows, that when two triangles are join'd together they will produce four, the two original ones will ſerve for top and bottom, and the two occaſional ones for the ſides; for all the four together will cloſe at the centre A, which is the point of ſight, where all the viſual rays do meet together, and according to the diſtance of the objects, thoſe above abaſe, thoſe below raiſe themſelves, and thoſe of the ſides cloſe themſelves as you ſee in *fig.* 7. *Plate* III.

The trees are produced by the ſame cauſe, bring forth the ſame Effect, where one triangle compriſes the air, another the earth, and the two ſide ones the trees. as *fig.* 8.

If the *Horizon* be equal with the elevation A, you draw from the foot of that elevation to the point of ſight B and all the figures, which are at diſtance muſt receive their proportionable height from the perpendicular C I drawn from the horizon between the firſt figure and the viſual ray, or line of ſight, as you have it explain'd in *Plate* VI. *fig.* 1.

If the *Elevation* be above the horizon you proceed in this manner; Having drawn the horizontal line, you mark thereon the point of ſight; ſuppoſe the firſt elevation D E to be half its height above the horizon, or let it be a quarter, then you draw from the bottom and the top of that elevation to the point of ſight F, and between theſe lines you draw perpendiculars for the elevation of the figures G H which are at ſome diſtance. *See fig.* 2.

When the horizon is high, we muſt from the firſt figure I, draw its height to any place of the horizon, which is here to the point K, all the heights of the other figures muſt be done between the triangle K L M, which will determin their height at their reſpective diſtances, as is plainly ſhewn in *fig.* 3. *Plate* VI.

Figures that have their feet on the horizon are proportioned according to the height of the firſt or principal figuer A, by drawing a line from the head, or a meaſure of its height to any part of the horizon, the perpendiculars B C between both, will give the heights required ; painters or engravers will take care to make the principal figure ſtrongeſt and the moſt finiſh'd. *See Plate* IV. *fig.* 1.

Figures raiſed upon pedeſtals muſt have the ſame height, as tho' they ſtood upon the plane, in which you proceed as delinated in *fig.* 2. Where A has the ſame height as B, and C is equal in height to D. and E is equal to that of F. *See fig* 2. *Plate* VII.

The ſame rule is to be obſerv'd in figures which ſtand lower than the baſe or plain, as you ſee *fig.* 3. Where G is equal in hight to H and I to K.

The height of figures ſeen far beyond a hill, or any other eminence, are found by drawing the natural height of a man, horſe, &c. from the foot of the mountain to the point of ſight, and proceed as has been directed, obſerving that the figures elevated on the hill or tower where your firſt figure ſtands muſt be of the ſame dimenſion in height, as muſt any other figure that ſtands upon an eminence on the ſame ground with the firſt figure, as for example in *fig.* 1. *Plate* VIII. Suppoſing the hill to be 25 foot high; the firſt figure we will ſay is 5 foot, the ſecond figure ſtanding 20 foot high, reaches up to the top of the hill and meets the horizon. The figure on the hill being of the ſame height as the two former, has his feet upon the Horizon. the little figures beyond the hill are drawn according to the perpendiculars as *a* to *a*, *b* to *b*, and *c* to *c*.

Beaſt are done by the ſame rule as men and other figures, as for example *fig.* 2. *Plate* VIII. having drawn the firſt horſe A, and from his height to the point of ſight, the perpendiculars will be marks for the proportion of thoſe at a diſtance, as B to *b*, and C to *c*.

Bird

PLATE. VII. p. 266.

Fig. 1.

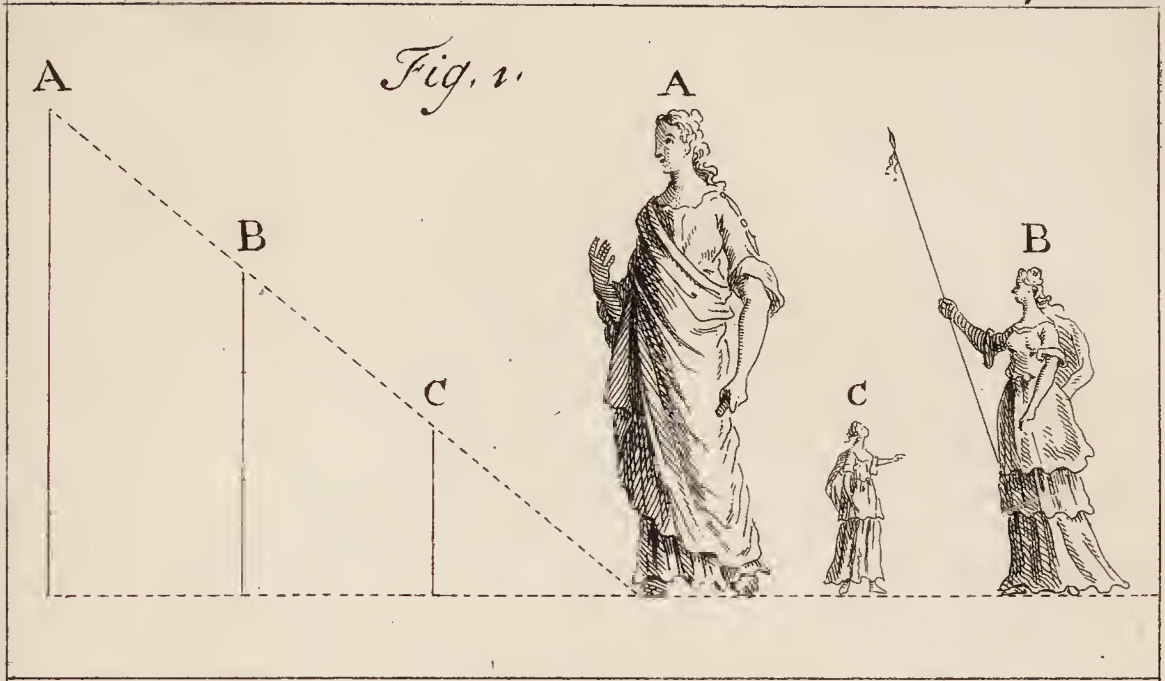


Fig. 2.

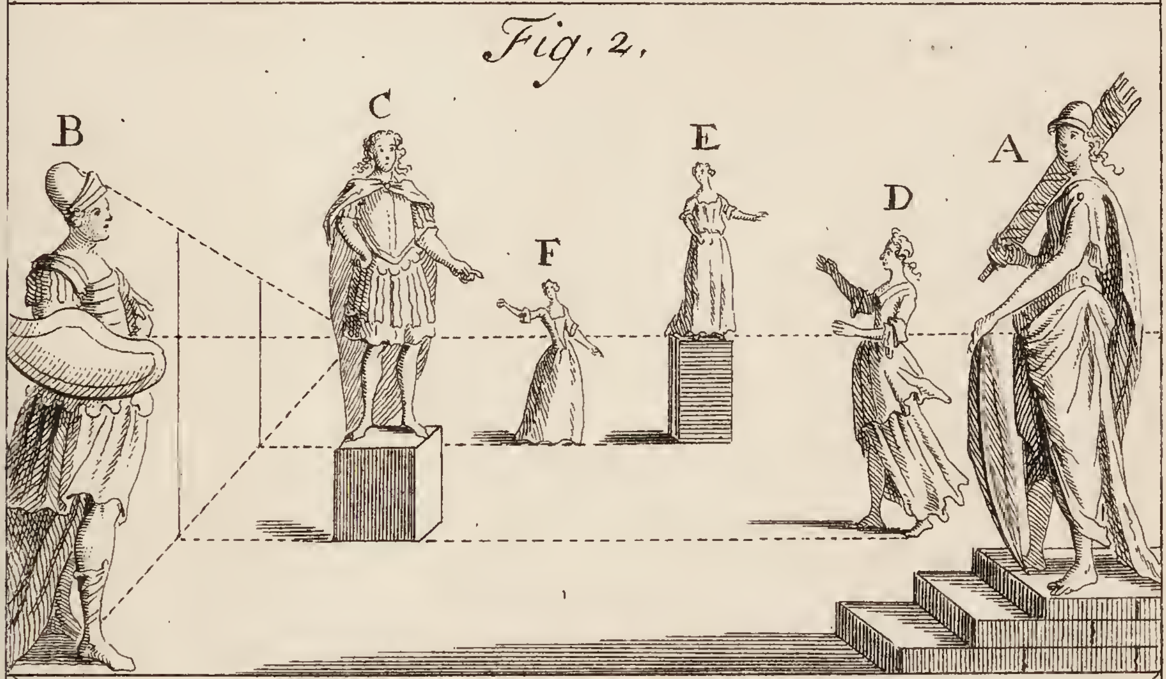


Fig. 3.

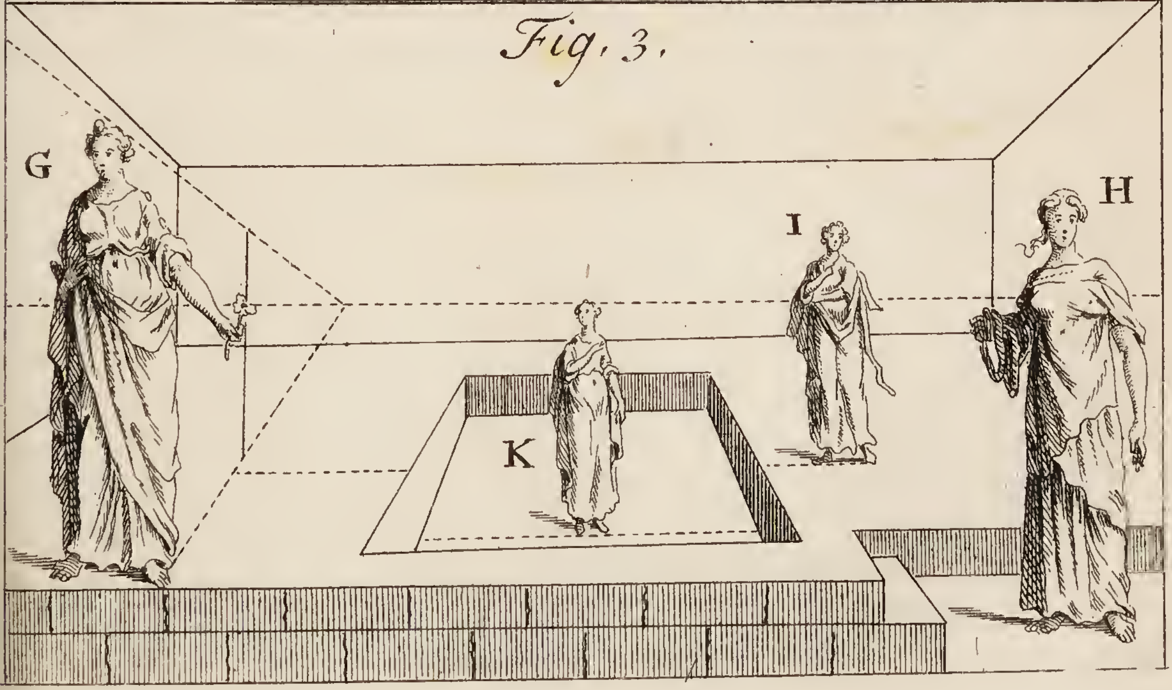
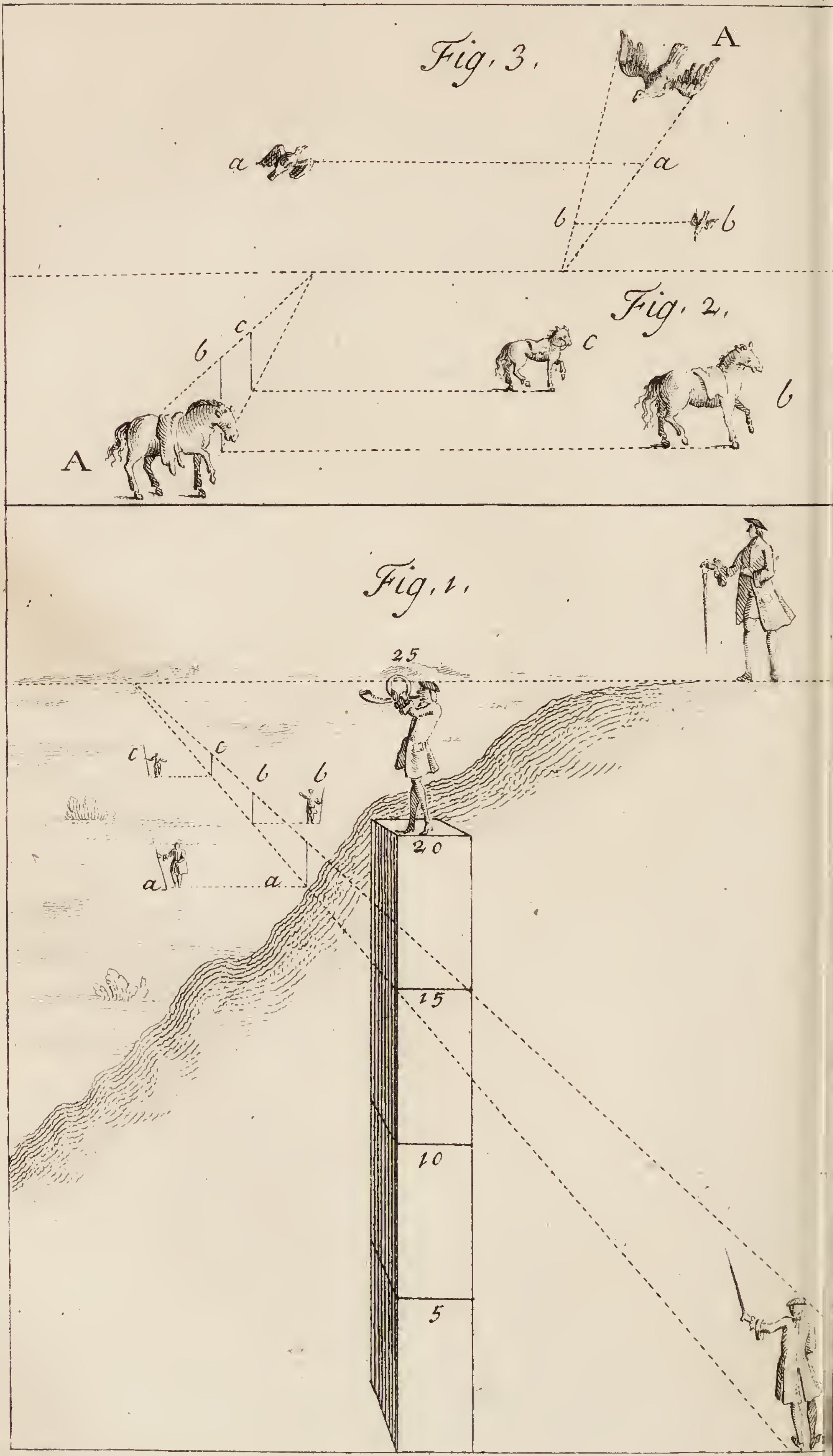


PLATE. VIII.



Birds flying in the air, one muſt draw from the ends of the wings of the firſt bird A to the point of ſight on the horizon, and the parallels between the firſt bird and the point of ſight will give a due proportion to the reſt, as *a* to *a*, and *b* to *b*. *See fig.* 3. *Plate* VIII.

If you draw chairs, tables, boxes, *&c.* in perſpective you muſt obſerve the rules of ſcenography: *See fig.* 10. *Plate* I. —— Doors, windows, window-ſhutters deſcry either a part or the whole of a ſemi-circle, according as their opening is more or leſs, which from the plane of ſquares, you may eaſily bring into perſpective by the ſame rules.

Of MOSAICK WORK.

How to perform it artfully.

UNDER the name of moſaic-work, are included ſuch performances as relate to inlaid work; as tabletures of ſtone, wood, metals, *&c.* What I am now treating upon, is that which repreſents not only all manner of figures, in their proper colours, attitudes and ſhapes, as large, as thoſe that are laſting ornaments in churches, and other publick edifices, but alſo in ſmall, and fit to grace the cabinets of the great and curious, and imitate a picture painted in miniature.

The ancients who practiſed this art with much skill and exactneſs, have left a variety of their performances, which are found not only in *Italy*, *Spain*, &c. but alſo here in *England*. Thoſe remaining at *Rome* are the fineſt, in the temple of *Bacchus*, now that of St. *Agnes*; and there are alſo curious pieces of that kind ſeen at *Venice*, *Piſa*, *Florence*, and other places.

The modern artiſts have improved very much in this performance, and whatever traveller has been at St. *Peter*'s and the palace of *Burgheſe* at *Rome*, St. *Mark's* at *Venice*, and the church of St. *Felicia*, at *Florence*, will confeſs to have ſeen wonders.

Such figures are compoſed, joined and cemented together of various coloured ſtones; but ſince nature has ſcarcely, at leaſt not ſufficiently ſupplied the proper ſhades requiſite for a maſterly performance, that defect has been made up by counterfeiting thoſe colours by art in glaſs, and this is done in the following manner:

The glaſs materials in the crucibles or melting pots being in fuſion, put in ſuch a colour as you would make your ſhades with, in the manner you have been before directed, in the art of making artificial gems, beginning with the lighteſt; having mix'd it well and taken out the quantity you think proper with an iron ladle, put it on a ſmooth marble, flatting it with another to a proper thickneſs, then cut it quick into ſmall pieces, laying them when cold up in a box for uſe; then add more colour, and proceed as before, repeating it till you come to the deepeſt ſhade. If you would gild them, then wet them on one ſide with gum water, lay leaf gold upon them, and in an iron ſhovel, covered with pieces of other glaſs, heat them red hot in the mouth of a furnace; then take them out, and when cold, the gold will be ſo fix'd and firm that nothing can hurt it.

When you begin to work, lay a thick ground againſt the cieling or wall, with plaſter, and having your deſign ready drawn and painted on blue or brown paper, clap part of it upon the wet plaſter, and with a pair of ſmall plyers, take up the ſmall ſtones, and preſs them in their proper places; thus form the figures and ſhades in their reſpective colours, as you are directed by your painted model. In this manner is done the hiſtory of our Saviour's walking with *Peter* on the ſea, in St. *Peter*'s church at *Rome*.

PART

PART XI.

Of Several Sorts of COSMETICKS, ODORIFEROUS WATERS, OILS, *&c.*

How to beautify the Skin:

TAKE rye bran, ſift it through a fine ſieve, and repeat it till it is clear from all the flower; then ſoak it for three or four hours in white wine vinegar, and putting in ſome yolks of eggs, ſtir it together, and diſtil it in *Balneo Mariæ:* the water thus drawn off is an excellent cleanſer and beautifier of the skin.

Another.

TAKE parſly, nettle ſeed, and peach-kernels, of each an equal quantity, boil them in fair water, with which waſh your hands or face: *Or.*

Take lemons and hard boiled eggs, cut them in ſlices, and lay them one over the other in a ſtill, the bottom of which you firſt cover with well waſh'd turpentine. The water that is diſtilled from it preſerve for uſe: *Or,*

Boil the bloſſoms of roſemary, allum and tarter in wine, with which waſh your hands and face:

Take ſlices of lemons and dry'd beans; let them ſoak in wine; add to it ſome honey, eggs, and goat's milk, then diſtil it: *Or,* Diſſolve camphir in pump-water, and waſh yourſelf therewith.

A Water for to take off the Spots in the Face, and to prevent the Hands from chopping.

TAKE a white pidgeon, pluck off the feathers, cut off the head and feet, gut it clean, and then, together with two pints of milk, three ounces of cream, and ſix ounces of oil of ſweet almonds, diſtil it in a glaſs alembick: with this water waſh your hands and face every day; it will keep them always white, ſoft, and without any ſpots or pimples.

To take away little red Pimples from the Face.

TAKE two ounces of lemon juice, two ounces of roſe-water, two drams of ſilver ſublimed, and as much ceruſe; put all this together, and mix it up to an ointment: with this anoint your face going to bed; the next morning, when you get up, anoint it with freſh butter, and then rub it clean off.

A fine Water for beautifying the Face:

TAKE a couple of calves feet, boil them in 18 quarts of river water, to half the quantity; then put in of rice and crumbs of fine bread ſteep'd in milk, two pound; freſh butter two pound; the white of 10 new laid eggs; mix all together and diſtil it; put into the diſtill'd water a little camphir and allum, and you will have a fine beautifying waſh.

An odoriferus Water.

TAKE of freſh roſemary flowers two pound, amber one ſcruple, orange, lemon, and citron-water three pints; put this by in a well cloſed glaſs veſſel, for ten days; then diſtil it in *Balneo Mariæ*, and keep the water for uſe. *Or*, TAKE orange and green lemon-peel, of each half an ounce, cloves one ſcruple, freſh ſpike bloſſoms ſix ounces; mix all theſe things together, with three quarts of damask roſe-water, let it ſtand covered up for ſome days, then diſtil it in *Balneo Mariæ*, and the water will be excellent.

To prepare the Cloth of the Levant for Ladies to colour their Faces.

TAKE ſhavings of ſcarlet cloath, boyl it for ſome time in water, wherein Quicklime has been diſſolv'd: then ſtrain it, an to the quantity of a quart put an ounce of roach allum, and the ſame weight of verdegreaſe, together with one quarter of an ounce of gum arabeck: having boil'd it for the ſpace of half an hour, take an old piece of linnen cloath, of what bigneſs you pleaſe, and put it into the decoction or red colour, cover the pan, and let the ſaid liquid cool for the ſpace of a day, then take out the cloth or handkerchief, you have dyed, dry it in the ſhade, and keep it in a box among odoriferous and ſweet ſented things, and uſe it when there is occaſion.

To prepare Oil of Benjamin.

TAKE an earthen pot that is high and narrow with a little border round it; put into it three or four ounces of clean benjamin groſly powder'd; cover the pot with a pyramidal paper cover, and tie it round about under the border; ſet the pot into hot aſhes, and when the benjamin is heated the flowers will ſublime; take off the cover every two hours, and fix another in its place; ſtop up quickly in a glaſs the flowers you find in the covers, and when thoſe which afterwards ſublime, do begin to appear yellow, take the pot off the fire and let it cool. You will find a black and ſhining matter cleaving to the bottom of the pot, which is taken off with a warm ſpatula, it is light, eaſy broken, and of a ſtrong ſmell if it comes near the fire; pulverize the ſame groſly and put it into a retort of a ſufficient bigneſs, and fill it only a third part, place it upon the ſand, and having fitted a receiver, lute the joints, and make a ſmall fire underneath, in order to heat the retort, and to diſtil an oil, part of which will become thick in the receiver; continue the ſmall fire till nothing more diſtils; keep this oil in a glaſs bottle, its colour is red, the odour is agreeable, and its taſte ſharp and pungent,

Oil of Roſes.

TAKE the ſeed of melons, well cleanſed and ſtamp'd in a ſtone mortar, lay them in rows or beds, together with roſe-leaves, for the ſpace of eight days, then take a little linnen bag, wet it in roſe-water, and put into it the melon ſeeds and roſe leaves; having tied it cloſe, put it between a preſs, and preſs out the oil; this oil is very precious, and therefore preſerve it carefully cloſed up in a little phial.

Oil of Cloves.

TAKE ſweet almonds, ſcrape and cleanſe them with a knife, break them in pieces, and ſteep them in roſe water, ſtamp alſo cloves, temper and ſteep them likewiſe in roſe-water, ſo long till it has extracted the virtue of the cloves, then put both the almonds, cloves, and the waters of each together, leave them till you find them ſwell'd, then take them out, dry them in the ſun, and when dry, put them again into the water to ſwell, repeat this five or ſix times. Then put them into a preſs, and preſs out the oil; which keep in a phial ſtop'd cloſe. In this manner you may make oil of musk, amber, cinamon, mace, nutmegs.

Queen of Hungary's-*Water.*

FILL a glaſs or earthen cucurbit, half full of roſemary-flowers, gather'd when in their prime, infuſe them in ſpirit of wine, ſet it in a *Balneum*, join to it the head of the receiver, luteing the junctures well; give a digeſting fire for three days; after which unlute them, and pour what has been diſtill'd into the cucurbit; refit your alembick, and increaſe the fire ſtrong enough to make the liquid diſtill, ſo as one drop may immediately follow another; when you have drawn two thirds of it, and put out the fire, let the veſſels cool, and unlute them, and you will find in the receiver a very good *Hungary* water; keep it in a phial well ſtopt; it is good in palpitations and ſwooning, in the palſy, lethargy and hiſterical diſeaſes; the doſe is from one dram to two. Outwardly it is uſed for burnings, tumours, cold pains, palſy, and is very reviving to the ſpirits.

Ladies do uſe it to beautify their complexion, by mixing half an ounce thereof with ſix ounces of lilly-water or bean-flower-water; waſhing their faces therewith.

To make Balls for taking out Spots of Oil or Greaſe.

TAKE ſoft-ſoap, incorporate it with aſhes of vines, finely ſifted, of both an equal quantity: then add to it roach allum burnt, and tarter, well beat into powder, incorporate all together and form thereof little round Balls, and lay them by for uſe when occaſion requires to make uſe of them.

To prepare a Leather Strop.

PROCURE a piece of leather, very ſmooth on the fleſh ſide, and about two inches broad, glew it to a thin board of the ſame breadth; and when dry, ſmear it all over with tallow candle, and then hold it a little over the fire, 'till the greaſe is penetrated thro' the pores of the leather: and this repeat three times; afterwards, pour over it a little tripoly, waſhed clean, which with the greaſe work into the leather, ſo long, till the greaſe becomes warm; then pour on freſh tripoly; repeating this operation four or five times, till the leather is fit for uſe. *Or,*

TAKE fine powdered emery, ſteep it in fair water, and then pour a good deal more upon it; ſtirring it well together. Let it ſtand a while to ſettle, pour off the water, and put one end of a linnen or woollen rag to the Bottom of the ſettled emery, and let the other hang out, in order to draw off all the water from it, which being become dry, rub it into the greaſed leather, in the ſame manner as you did the tripoly; only work in the emery with a piece of ſmooth ivory, or elſe with a burniſher; after this ſtroak your razor ſoftly over it, and the effect will be, that razors thrown aſide as uſeleſs are now recovered to ſuch a degree, as to be fit for ſhaving: Now as one razor is ſofter than another, you muſt paſs a ſoft one on a ſtrop, prepared with tripoly; and a hard one upon a ſtrop prepared with emery.

How to make Pruſſian Blew.

TAKE a ſalt, which by chymiſts is call'd fix'd alcali ; and is of the ſame nature with that of pot-aſh, mix it up with ſome oily inflammatory matter : the blood of cattle, deſiccated, will anſwer the purpoſe as well as any Thing : then calcine this matter in a crucible, 'till you ſee only a blew flame on its ſurface. All the ſaline part of this calcined matter you diſſolve in hot water, then ſtrain it. This lye, you mix with alum and green copperas, both which ingredients you firſt diſſolve ſeperatly in water. The mixture of theſe ſaline liquids cauſes a fermentation, they grow muddy and of an unpleaſant green : Afterwards you filtrate the whole through a brown paper, in glaſs funnels ; The Liquor paſſes clear and leaves a green ſettlement on the brown paper : then you pour an acid liquor, ſuch as aquafortis weakened with water on thoſe ſettlings, and they turn to a fine blew : which when dry you put up for uſe.

PART XIII.

Of Artificial FIRE-WORKS.

HAVING in the preceding ſeventh part of the *Laboratory*, already given a ſufficient account not only concerning the nature and property, but alſo the management of ſaltpetre, in promoting of its growth, in cleanſing and refining the ſame, &c. it would be needleſs here to enlarge upon that ſubject, except it were of ſuch things that have there been omitted, and are of uſe in the management of artificial fire-works,

How to boil Saltpetre to a Powder.

TAKE a clean kettle or pan, put in as much ſaltpetre, as to lay at leaſt two fingers thick; pour on it ſo much water as will juſt cover it; put it on a ſlow fire, and when the ſaltpetre is diſſolved, take off the impurities with a ſkimmer, and let it boil gently till it begins to thicken, keep it ſtirring continually, till it is turned to a white ſand or flower; then take off the kettle, and pour out the ſaltpetre on a table or board, ſpreading it thin, to cool.

How to melt Saltpetre.

PUT a crucible with ſaltpetre on charcoal; when melted, take off the ſcum carefully; then fling a little piece of brimſtone upon it, and when that is burnt, pour the melted ſaltpetre on a clean metal plate or ſtone, and it will be of a fine white colour, tranſparent and like alabaſter.

N. B. To one pound of ſaltpetre, take half an ounce of brimſtone.

Of Sulphur, or Brimſtone.

SULPHUR is by nature the food of fire; it is the principal ingredient in gun-powder, and all ſorts of fireworks. Among brimſtone, that which is of a high yellow, and which when held in one's hand, creckles and bounces, is the beſt.

How to ſtrengthen Brimſtone.

MELT as much of the cleareſt brimſtone as you will, in a kettle or other utenſil, and when the greateſt heat is over, then put into it, for each pound of brimſtone, half an ounce of quickſilver, ſtir them well together, till the quickſilver and brimſtone are united, then pour it out into brandy; inſtead of quickſilver, you may uſe the ſame quantity of cinnaber, and it will do as well.

How to break or granulate the Brimſtone.

TAKE ſome ſpirits, put a handful of brimſtone therein and let it diſſolve; then take a broad ſtick, and ſtir it about till it grows mealy, and runs like ſand. If you would have it ſtrong and hard, fling a handful of ſaltpetre into it.

How to prepare the Oil of Saltpetre.

PUT ſome good refined ſaltpetre upon a dry and well plained deal-board, underneath which place a copper baſon, round about make a coal fire, and the heat thereof will draw the ſaltpetre, changed into an oil, through the board, and it will drop into the baſon: this you may continue as long as you will, by recruiting the board with freſh ſaltpetre.

To prepare Oil of Sulphur.

FILL a matraſs with fine pulverized brimſtone about one third full; on this pour as much nut or elder oil as will fill the matraſs half full, ſet it in warm aſhes, and let it ſtand for 8 or 9 hours; and the oil will change the brimſtone to a fiery red oil.

To make Sal-armoniac Water.

TAKE three ounces of ſal-armoniac, one dram of ſaltpetre, pulverize it fine, and mix it together; then put it into a matraſs, pour on it ſtong vineger, and diſtil it over a ſlow fire; then dry and refine it.

To make Camphir, and the Oil thereof.

TAKE of pulveriz'd juniper-gum two pound, and of diſtill'd vinegar enough to cover it, put them together into a glaſs phial; ſet it for 20 days in warm horſe dung, then take it out again, and pour it out into another glaſs, with a wide mouth to it, expoſe it to the ſun for a month; and you will have a concreted camphir, like a cruſt of bread, which is in ſome meaſure like the natural camphir: this, for uſe in fire works, is wrought to a powder by grinding it with ſulphur in a mortar.

The oil of camphir which anſwers the ſame end is produced by adding a little oil of ſweet almonds, and working it together in a braſs mortar and a peſtle of the ſame metal, thus it will turn into a green oil.

How to prepare Oil of Brimſtone and Saltpetre at once together.

TAKE brimſtone and ſalt-petre an equal quantity of each, mix them together, grind them to a fine powder, ſift them through a fine ſieve; then put it into a new earthen pot, pouring as much ſharp vinegar or brandy to it as is ſufficient to cover it; then lute up your pot cloſe, ſo as to prevent any air entring into it, ſet it in a warm place, till the vinegar or brandy is quite digeſted, then take the remains, and extract it in a chymical manner.

To prepare Charcoal for Fire-works.

COALS are a preſervative, whereby the fire, which by the brimſtone is brought into gun-powder, may not ſuffocate the ſtrong and windy exhalation of the ſaltpetre.

The charcoals are of ſeveral ſorts; ſome prefer thoſe burnt of hazle and willow wood; when you go to burn them, ſplit the wood about one foot long, in four equal parts, ſcale off the bark, ſeparate the pith and hard knots; dry them in the ſun or in a baker's oven; then make in the earth a ſquare hole, line it with bricks and lay the ſplit wood therein, croſſing one another, and ſet it on fire; when thoroughly lighted and in a flame, cover the hole with boards and fling earth over it cloſe, to prevent the air from coming thereto, yet ſo as not to fall among the coals; having lain thus for 24 hours, take them out and lay them carefully up for uſe.

To make the Moulds for Rockets.

THE rockets bearing the pre-eminence, and being the principal things belonging to a fire-work, it is requiſite to give ſome definition of every part of them, how they are made, finiſh'd and fired: in order to do this, I ſhall firſt endeavour to give the curious ſome idea concerning the moulds they are formed in, theſe are turn'd commonly of cloſe and hard wood, as of white plumb-tree, box, cheſnut, cypreſs, juniper, *Indian* wood, *&c.*

Some alſo are made of ivory, and for rockets of extraordinary large ſizes, they are caſt in braſs or copper, and turn'd the inſide in a nice manner, the foot or baſis with its cylinder, wart or half bullet may in theſe as in others remain of ſolid wood. The whole is commonly turn'd in the ſize and form of a column in architecture, and embelliſh'd with ornaments, according as you fancy.

The

PLATE. I.

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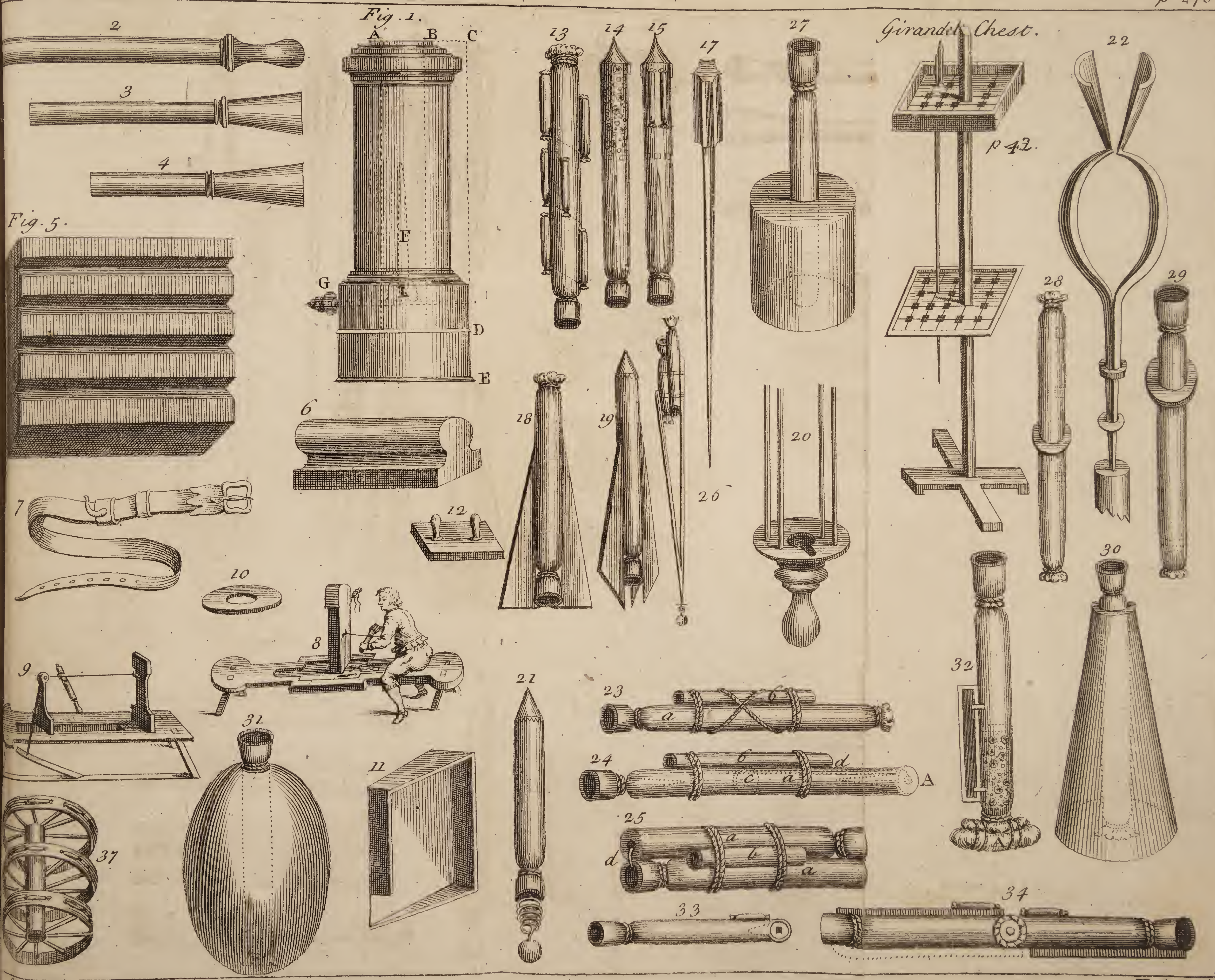


Smith del.

Hulett Sculp

The order to be obſerved in the ſize of the cylinder: it is agreed by the moſt famous artificers, that the moulds of all rockets from a half to ſix pound, ought to be ſix diameters; but the larger ſize of four, four and a half, or five diameters of their orifices high.

Thoſe rockets which go under the denomination of ſmall ones, are thoſe whoſe inward diameter cannot receive a ball that exceeds one pound. The middling ſort are thoſe whoſe diameter can admit balls of one, two or three pound; and great ones are ſuch, whoſe bore will receive balls from three to a hundred pound.

Rocket moulds from ſome ounces to three pound, are ordinarily ſeven diameters of their bore long, the foot two or three diameters thick, the wart two thirds of the diameter, and the piercer one third of the bore, the roller two thirds, and always one or two diameters from the handle longer than the mould; the rammer one diameter ſhorter than the mould, and ſomewhat thiner than the roller to prevent the ſacking of the paper when the charge is ramm'd in, having always one ſtill ſhorter, that when the ſhell of the rocket is ramm'd half full, you may uſe that with more eaſe. For the better illuſtration, ſee fig. 1. repreſenting the mould with its baſes, cylinder, bore and piercer. A B the interior diameter of the mould. C D the height of the mould, ſeven diameters; from D to E, is the height of the breech at bottom, which ſtops the mould when the rocket is driving, and this is one and $\frac{1}{3}$ diameter. Upon this bottom you have a ſolid cylinder, whoſe height is one diameter of the orifice A B, this cylinder is crowned with a wart or half bullet I, having a hole in the center, in which is fixed the iron or copper piercer F. G. an iron pin that keeps the bottom and cylinder together. 2. The rowler. 3 The rammer. 4. The ſhorter rammer.

It is to be obſerved, that ſome of theſe moulds are made 9 diameters of their orifice long, the ſhell therefore with the wart will be 12 diameters. Theſe ſorts of rockets fly very high, becauſe of their length, they containing a greater charge than the ſhort, nevertheleſs the piercer needs to be no longer than ſeven diameters, but ſubſtantial, ſo as to keep in its proper attitude; it will require the dimenſion of two thirds of the diameter at bottom, and from thence tapering to half the diameter.

How

How to prepare Caſes for Swarmers or Rockets.

THE caſes or trunks of rockets are made of different ſorts of things, namely of paper, wood, tin, paſteboard, linnen, leather, *&c.*

In paper caſes, which are for the generality moſt made uſe of, it muſt be obſerved, 1. That great care ought to be taken in winding or rolling them upon the roller, tight and cloſe. 2. That the concave ſtroke be ſtruck clean, ſmooth, and without large wrinkles: And 3. That each ſort of caſes be of an equal length and ſize.

The rocket ſhells being very tireſome for two perſons to make by hand, a machine has been invented for the eaſement thereof. It is made of an oaken board, about two foot wide, and three or four inches thick, plan'd, ſmooth and cut out into channels or grooves of different ſizes, to ſerve for greater or leſſer rockets, and is commonly called the ſaddle; to theſe ſort of ſaddles are alſo made preſſers, whereby the caſes on the roller are preſſed down with a heavy hand; the handle of the roller having a hole in the middle, a ſmall iron bar is put in, and as the man preſſes with one hand, he turns the roller with the other; and by this means the paper is brought as tight as it ought to be. See Fig. 5 and 6.

For four and ſix pound ſhells it is to be obſerved, that each ſheet of paper (except the firſt and laſt, in the part where the neck is formed) be a little moiſtened.

The necks of rockets may be formed ſeveral ways; for thoſe of three quarters of a pound, a well twiſted pack-thread will do, which having one end tied to a ſtick and put between ones legs, and the other to a poſt, will draw it cloſe with eaſe. The large ſhells require more ſtrength, one end of a ſtrong cord being faſtened to a poſt, and the other to the belt with a hook, as Fig. 7, and this by main force draws the cord twiſted about the neck of the caſe, as you ſee in Fig. 8

Some make uſe of a bench, on one end whereof is fix'd a poſt, to which a cord is fixed and conveyed over a pully and thro' a hole in the bench, to a treddle, to which it is faſtened, whereby the necks are forced very tight. See Fig. 9.

The necks of extraordinary large ſiz'd rockets are forc'd with ſtrong cords over ſcrews and round neck'd irons, proportioned to the ſize of the ſhell. See Fig. 10.

The wooden, tin and paſte-board rockets, are ſupplied with necks, turn'd of wood, joined, and faſtened through the ſides of the ſhell with wooden pegs.

How to prepare the Charges for Rockets, and order the Fires thereof to be of various Colours.

BEFORE you begin to charge the ſhell of the rocket, be very careful that the powder is well work'd and clean'd; that the ſaltpetre is thoroughly refin'd, and made into an impalpable powder; that the brimſtone be well cleanſed and brought to the higheſt perfection; that the coals be of lime-tree or other ſoft wood, well burnt, powder'd, dry'd and ſifted, and all theſe ingredients be well mix'd together and ſearched through a fine ſieve.

When you are ſatisfied in thoſe things, and have weighed the proportionable quantities of each, put the mixture into the work board Fig. 11 and grind it therein with the grinder, Fig. 12. for an hour together; then try your charge by ſifting a little on a table, and if, when lighted, it burns away in an even fire, and does not fly up; it is a ſign that it is work'd enough; but if at one place it burns quicker than another, or doth ſtop its courſe, then you muſt grind it more. The charge being thus prepared, you muſt put it up ſafe in a moderate place, that is neither too hot, cold, nor damp, in a box or other dry veſſel; and when you charge your rocket, then ſprinkle and mix the charge with a little brandy.

Having ramm'd a rocket for tryal, fire it in a ſecure open place; if it mounts even and high, and gives a report as ſoon as it turns, it is a ſign of being made to perfection; but if the rocket burſt as ſoon at it is lighted, then the charge is too fierce; or if it raiſes a little, and falls back, then the charge is foul and weak; the former is rectified by adding more charcoal, and the latter by ſome meal-powder; for the reſt it muſt be obſerved, that the larger the rockets be, the weaker muſt be the charge; and on the contrary, the ſmaller they be, the ſtronger muſt be their charge.

If you would repreſent a fiery rain falling from the rocket, mix among your charge a compoſition of powder'd glaſs, filings of iron, and ſaw-duſt; this ſhower is commonly call'd the peacock's tail, on account of the various colours that appear in it

You may alſo exhibit variety of colours iſſuing forth from a rocket, by mixing among the charge a certain quantity of camphir, which produces a white or pale fire; roſin a red and copper colour; blood-ſtone, which has been nealed and beaten to a palpable powder, will yield a blood red; ſulphur a blue; ſal-armoniac a green: raw antimony a reddiſh or honey colour, ivory ſhavings, a ſhining ſilver, filed agat ſtone an orange, and pitch a dark and deep colour'd fire; this muſt be manag'd with diſcretion, and practice will be the beſt teacher in that particular, for long leſſons are more fit to perplex a young beginner than put him forwards.

The charges are commonly divided into three ſorts or degrees, *viz.* in white, gray and black. I have, the better to guide beginners in this art, ſet down ſeveral ſorts of charges, according to the proportion of rockets, but without diſtinguiſhing the three ſeveral colours; wherefore you have to obſerve, that to the grey charges, are four ingredients, *viz.* meal-powder, ſaltpetre, brimſtone and charcoal; to the white charges three ingredients, *viz.* ſaltpetre, brimſtone, and charcoal; and to the black charges two ingredients, *viz.* meal powder and charcoal.

Charges for Land Swarmers, or Small Rockets.

MEAL-powder one pound, and charcoal one ounce.

Or,

Meal powder five ounces, and charcoal half an ounce.

Meal powder fifteen ounces, and charcoal two ounces.

Meal-powder ſix onnces, ſaltpetre four ounces, brimſtone one ounce, charcoal one ounce and three quarters. This laſt may be uſed for the fuzee of others.

Charges for Water Rockets.

SAltpetre two ounces, brimſtone half an ounce, and charcoal one ounce and a half.

Meal-powder one pound and a half, ſaltpetre four pound, brimſtone two pound, and charcoal five ounces.

Meal-powder four ounces, ſaltpetre one pound, brimſtone eight ounces, and charcoal one ounce.

Saltpetre two ounces, brimſtone half an ounce, and charcoal half an ounce.

A general Charge for Rockets of two and three Ounces.

MEAL-powder twelve ounces, ſaltpetre two ounces, brimſtone half an ounce, charcoal one ounce and a half.

Charges for Rockets of four, five, and ſix Ounces.

POWDER fifteen ounces, ſaltpetre twelve ounces, brimſtone one ounce and a half, and charcoal four ounces.

Powder one pound and a half, ſaltpetre one pound and a half, brimſtone ten ounces and a half, and charcoal twelve ounces.

Powder two pound, ſaltpetre one pound, brimſtone three ounces, and charcoal fourteen ounces and a half.

Powder eight pound, ſaltpetre twelve pound, brimſtone two pound, and charcoal four pound.

Powder twelve ounces, ſaltpetre two ounces, brimſtone two ounces, and charcoal two ounces.

Saltpetre four pound, brimſtone fourteen ounces, and charcoal one pound.

Powder three ounces, ſaltpetre half an ounce, brimſtone half an ounce, and charcoal half an ounce.

Powder one pound and a half, charcoal three ounces and three quarters.

For eight, nine, and twelve Ounce Rockets.

MEAL-powder eighteen pound, ſaltpetre eight pound, brimſtone one pound, and charcoal four pound.

Powder four pound, ſaltpetre three pound and a half, brimſtone fifteen ounces, charcoal one pound four ounces.

Powder three pound, ſaltepetre two pound, brimſtone two pound, and charcoal one pound.

Powder three pound, ſaltpetre two pound, brimſtone one ounce, and charcoal one pound.

Powder nine pound, charcoal one pound eight ounces.

Saltpetre two pound four ounces, brimſtone eight ounces, charcoal fourteen ounces, and antimony four ounces.

Saltpetre one pound two ounces, brimſtone two ounces, and charcoal four ounces.

Saltpetre ten ounces and a half, brimſtone one ounce, charcoal three ounces, and braſs file-duſt half an ounce.

Saltpetre two pound four ounces, brimſtone eight ounces, and charcoal fourteen ounces.

For one, and one and a half Pound Rockets.

MEAL-powder three pound, ſaltpetre four ounces, brimſtone one ounce, and charcoal four ounces and a half.

Powder thirty-two pound, brimſtone two pound, and charcoal ſix pound.

Powder two pound, ſaltpetre two pound and a half, brimſtone twelve ounces, and charcoal one pound three ounces.

Powder ſix pound and a half, and charcoal one pound.

Powder three pound, ſaltpetre fifteen ounces, brimſtone four ounces, and charcoal ſeven ounces and a half.

Powder four pound, ſaltpetre one pound eight ounces, brimſtone ten ounces, and carcoal one pound twelve ounces.

Powder two pound, ſaltpetre one pound four ounces, brimſtone one ounce, and charcoal eight ounces and a half.

For two and three Pound Rockets.

MEAL-powder three pound eight ounces, ſaltpetre three pound ten ounces, brimſtone one pound four ounces, and charcoal one pound three ounces.

Saltpetre four pound eight ounces, brimſtone one pound eight ounces, and charcoal one pound four ounces.

Saltpetre ſixty pound, brimſtone two pound, and charcoal fifteen pound.

Powder two pound thirteen ounces, ſaltpetre fifteen ounces, brimſtone four ounces, and charcoal ſeven ounces and an half.

Powder twelve ounces, ſaltpetre one pound eight ounces, brimſtone ſix ounces, and charcoal ſix ounces.

Powder four pound, ſaltpetre nine ounces, brimſtone three ounces and a half, and charcoal ten ounces and a half.

Powder one pound, ſaltpetre eight ounces, brimſtone two ounces, and charcoal three ounces.

Powder eleven pound, and charcoal two pound ten ounces.

Saltpetre ſix pound four ounces, brimſtone one pound, and charcoal two pound and a half.

For four and five Pound Rockets.

MEAL-powder ſix pound, ſaltpetre four pound, brimſtone one pound and a half, and charcoal two pound ſix ounces. Or,

Saltpetre ſixty four pound, brimſtone eight pound, and charcoal eight pound.

For ſix, eight, or nine Pounders.

MEAL-powder twelve pound three quarters, ſaltpetre ſix pound, brimſtone two pound and a half, and charcoal five pound and a half. Or,

Saltpetre thirty-five pound, brimſtone five pound, charcoal ten pound.

Meal-powder twenty-two pound and a half, and charcoal five pound twelve ounces.

Meal-powder one pound, ſaltpetre half a pound, brimſtone two ounces, and charcoal three ounces.

Saltpetre nine pound, brimſtone one pound nine ounces, and charcoal three pound and a half.

For ten and twelve Pounders.

SAltpetre ſixty-two pound, brimſtone nine pound, charcoal twenty pound.

Powder eleven pound, ſaltpetre ſeven pound, brimſtone three pound, and charcoal ſix pound.

For fourteen, fifteen and ſixteen Pounders.

POWDER ten pound and a half, brimſtone nine pound three quarters, and charcoal ſeven pound.

Saltpetre twenty-three pound, brimſtone eight pound, and charcoal ſixteen pound.

For eighteen or twenty Pounders.

POWDER twenty-two pound, ſaltpetre ſixteen pound brimſtone ſeven pound, charcoal thirteen pound and a half.

Saltpetre twenty-four pound, brimſtone twelve pound charcoal twenty-ſix pound.

For thirty, forty, and fifty Pounders.

POWDER eight pound, ſaltpetre ſixteen pound, brimſtone two pound, and charcoal four pound.

Saltpetre thirty pound, brimſtone ſeven pound, and charcoal eighteen pound.

For ſixty, eighty, and a hundred Pounders.

SAltpetre thirty-ſix pound, brimſtone ten pound, and charcoal eighteen pound.

Saltpetre fifty pound, brimſtone twenty pound, and charcoal thirty pound.

T

To bore the Rockets, or ram them over the Piercer.

SINCE the boring of rockets is one of the principal things belonging to them, for their operating well, the bores are to be made in proportion to the ſize of the rockets, for ſome of them are bor'd tapering to a point; others are hollow'd ſquare, running alſo to a point; and others are rammed over a round piercer, which is fixed in the wart of the rocket mould, See Fig. 1. I. and ſtands perpendicular, running tapering to a point. The ſtronger the charge of the rockets, the narrower ſhould be the bore, and the weaker the charge, the deeper and wider; for if a ſtrong charge is bored too deep, it will break in aſcending, and if it is bored too little, and the charge too ſlow, it will fall to the ground without any effect: they are commonly in middling charges bored two thirds of the tube from the neck.

The boring muſt be performed ſtrait and even, and altho' ſome will give themſelves the trouble to bore them by hand, it is better, when a quantity is to be bored, to ſend them to a turner.

The rockets ſhould be bored but a few days before they are to be uſed, and kept in dry places, which you muſt alſo obſerve in other materials for fire-works.

The garniſhing of Rockets.

THIS is done ſeveral ways, for they may be both within and without furniſhed with crackers. On the outſide it is done in the following manner, *viz.* That end of the rocket which is ſolid, is divided into three equal parts, and then bored in the middle of each, quite to the charge; at the bottom of theſe holes paſte a ring of thin paper, upon which fling ſome meal powder; then fix in the crackers, ſtuffing the ſides with ſome tow or flax, and over that paſte a covering of paper, to cloſe the opening between the rocket and crackers.

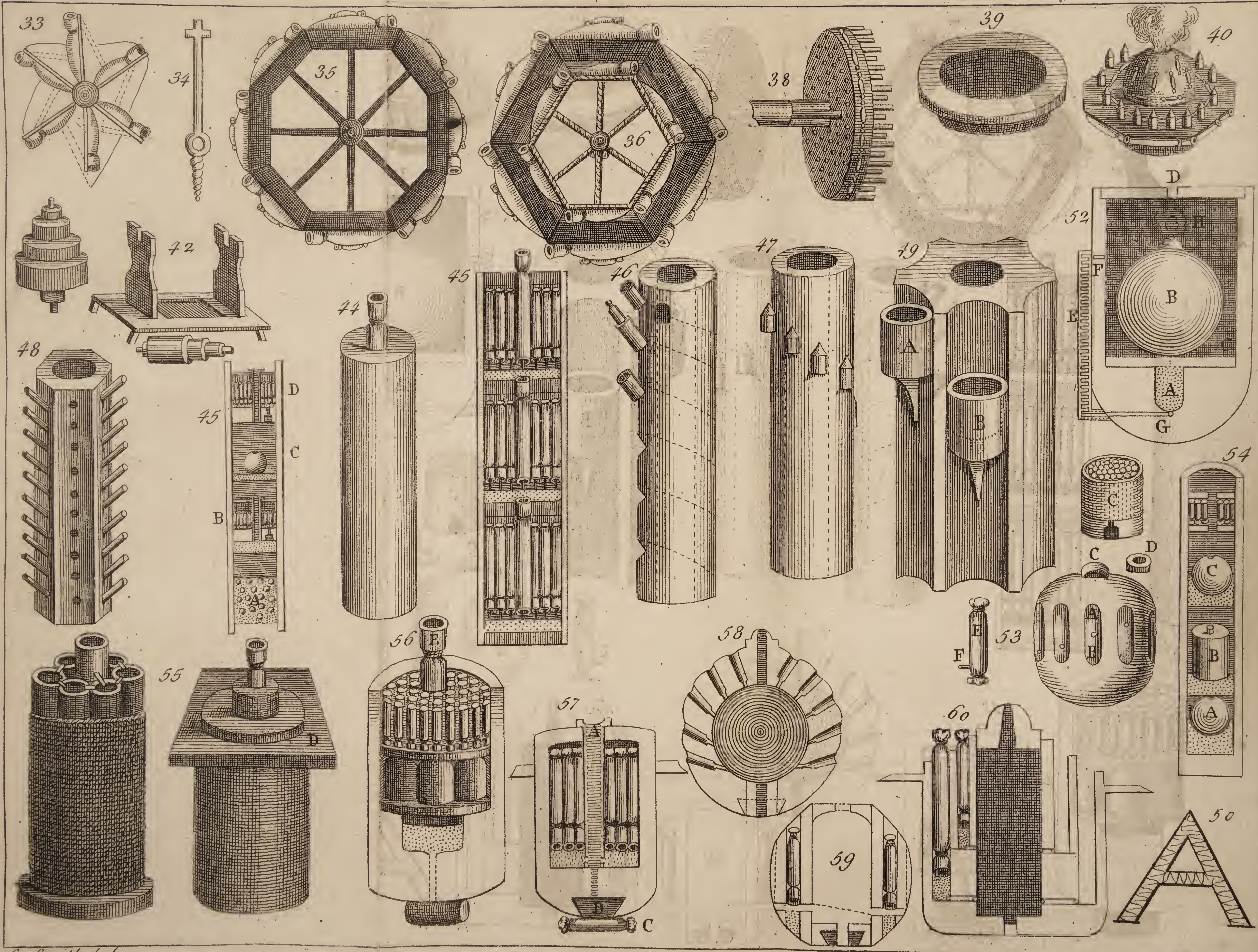
The inſide is furniſhed thus: put a ſmall round board, (in which you have bored ſeveral holes) upon the charge; then ſtrew meal powder in them, and fix your crackers, cover it with a cap, and paſte it to the outſide of the rocket.

You may alſo furniſh rockets both within and without with ſparks, ſtars, and fire-rain, when thoſe materials are joined either within or without. You may alſo fix to the large rockets, ſwarmers, by boring a touch-hole in both, filling them with meal powder, and after the touch-holes are fixed exactly on one another, glew them together with a bandage of paper; thus you may mark a winding figure with a thread on a rocket, and place your ſwarmers accordingly. See Fig. 13. You may alſo inſtead of ſwarmers, place a globe on the top of the rocket, charged with the compoſition of rockets, and fill'd with crackers; this globe muſt have a touch-hole, and be lighted before the rocket is let off, and it will have a good effect. Several other things may be done that way, as the genius of every virtuoſo in the practice therof will direct him. See Fig. 14, 15.

How to proportion the Rocket-Poles and Sticks:

IT is common to tie but one rocket to a ſtick; but ſix or ſeven may be placed round the thick end thereof, which muſt be worked with grooves, as you ſee Fig. 17. But as no rocket would aſcend high if it were not for the true balance obſerved in the pole or ſtick, you muſt further obſerve, that theſe ſticks are made of light, dry, and ſtrait wood, and muſt (to one and two pound rockets) be ſeven times as long as the rocket; which porportion of the ſmall ones of ſeven diameters, muſt alſo be obſerved in the larger ſort: That end where the rocket is tied to, muſt be two fifths, and below, one ſixth of the diameter thereof; it is beſt to give the turner an unbor'd rocket and one that is bor'd, thereby not only to meaſure the length, but alſo balance the weight. After the rocket is ty'd to the ſtick, take it four inches from the neck of that rocket not yet bor'd, and from the neck of the bor'd one about two or three fingers, ſo as to ſtand on the back of a knife or one's finger, in an equilibrium. In large rockets the poles muſt be eight or nine rockets long, and to find their balance, you take their libration twelve inches from the neck.

PLATE. II.



G. Smith del.

Hulett Sculp

Rockets without Sticks.

THERE are alſo rockets made without ſticks. Fix to the ſmall ones, from four to eight, nine, or ten ounces (after they are bor'd and ramm'd) four wings, in the nature of arrow feathers, made either of light wood or paſte-board, which are glued croſsways to the rocket: their length muſt be two thirds, and the breadth below, one ſixth of the length of the rocket; the thickneſs may be one eighth of the diameter of the mouth thereof. See Fig. 18, and 19. Theſe ſort of rockets are fired on a board or ſtand, placed between four ſmall ſticks; as you ſee in Fig. 20.

Others faſten one end of a wire, which is about a foot long, twiſted like a ſcrew, to the mouth of the rocket, and hang an iron ball to the other end, of an equal weight with the rocket. See Fig. 21.

Of Girandel Cheſts, how and with what the Rockets are fired therein.

THE girandel cheſt is made of wood, of what ſize you think proper, according to the number of rockets you deſign to fire at once.

The method of firing thoſe rockets is performed ſeveral ways; ſome fill the necks of them with meal powder, others with quick match, wherewith, or with gun-match, they fire them: the beſt way to light the girandel or other fire-works, is a match prepared on purpoſe in the following manner:

Cut ſome ſlips of paper of the length of half a ſheet, and about one or two inches wide; roll and glew each of them together over a little round and ſmooth ſtick of a quarter of an inch thick; this done take it off, and when dry, fill it with the compoſition hereafter mention'd, ramming it in by little and little with a leſs ſtick than that upon which you roll'd the ſhell. Theſe ſort of matches are put upon pointed pinchers, as you ſee in Fig. 22. and when they are lighted, cannot be extinguiſhed either by rain or wind.

The Compoſition.

MEAL powder three ounces and a half, ſaltpetre ſeven ounces, and brimſtone three ounces three quarters, moiſtened with linſeed oil.

Meal powder one pound, ſaltpetre one pound, and brimſtone thirteen ounces, moiſtened with linſeed oil.

Meal powder one pound, ſaltpetre one pound, four ounces, brimſtone four ounces, charcoal two ounces, roſin two ounces and a half, moiſtened with turpentine and linſeed oil, and work'd well together.

Meal powder twelve ounces, ſaltpetre four ounces, brimſtone three ounces and a half, charcoal an ounce and a quarter, turpentine one ounce, and tallow three ounces and a quarter; firſt melt the turpentine and tallow together, then ſtir the other ingredients among it, and pour it in the paper ſhells; when dry, they are fit for uſe.

Of Rockets that run upon Lines, or Ropes, from one Place to another.

THESE are made ſeveral and different ways, and to give them the more ſhew, ſome garniſh them with figures of various devices.

The firſt ſort is contrived by fixing two iron rings, or a wooden tube, to a rocket, fill'd with a certain quantity of a ſuitable compoſition, and bor'd as uſual; through theſe rings or tubes, is put a line, on which the rocket is to run; this is of the moſt ſimple kind, for being arrived at the place where the duration of its combuſtible matter will allow it to reach, it there ſtops. This ſort is repreſented in Fig. 23.

For the ſecond ſort, fill any rocket, whoſe orifice is equal to that of the former, but much longer, to the height of four diameters, bore it to the depth of three and a half. Upon this compoſition put a cap or little wooden partition, without any hole through it; glew this to the inſide of the rocket, or ſecure it any other way to prevent the fire, when arrived to that place, from catching hold of the compoſition contain'd in the other part of the caſe. This done, charge the remainder of the rocket to the ſame height as before, namely to four diameters, three and a half muſt be bored; after this choak the rocket at top, and make a little receptacle for the priming, as at the other end; or elſe fit a round piece of wood to it, with a hole through the middle, as you ſee in A Fig. 24. which you cover with a little cap; to this add on one ſide a tube made of a very thin iron plate, which fill with meal powder; then bore a hole thro' the ſide of the rocket, near the other ſide of the partition that is in the middle, fill it with meal powder; this is done to convey the fire thro' the tube to the receptacle A, where it lights the other rocket, and conſequently obliges it to return back to the place whence it came, the upper part which holds the priming muſt be covered with paper, as well as the ſmall tube, that conveys the fire from that to the other end. This rocket alſo muſt have two iron rings or a wooden tube to run along the line. You may make the diverſion the greater, by tying ſwall paper crackers all round. The contrivance of this rocket is very pretty. You have the repreſentation plain in Fig. 24, 25.

The decorations and devices that are uſually fixed to theſe running rockets, may be either flying dragons, pidgeons, mercuries, cupids, or any other fancy, as the occaſion of a feaſt or rejoicing requires.

Charges for the Line Rockets.

MEAL powder three ounces, ſaltpetre one ounce and a half, and charcoal three ounces, will be a right proportion for three, four, or ſix ounce rockets.

Meal powder eight ounces, ſaltpetre two ounces, brimſtone half an ounce, and charcoal one ounce.

Meal powder nine ounces, ſaltpetre one ounce, brimſtone three quarters of an ounce, and charcoal four ounces.

Meal powder fourteen ounces, ſaltpetre ſeven ounces, brimſtone two ounces, and charcoal four ounces.

Theſe charges may be uſed for ſixteen and twenty-four pounders.

Meal powder one pound, ſaltpetre half a pound, brimſtone three ounces, and charcoal five ounces. This charge is proper for three quarters and one pound line-rockets.

It will be adviſeable to make ſome trials of the charges that you may be ſure of not failing in the performance. See Fig. 23, 24, 25, where, *a* is the rocket, *b* the tube, or inſtead thereof ſome rings that ſlide upon the cord, *c* the partition, *d* the pipe for the communication of the fire from one rocket to another.

How to join two Rockets to one another, the one to burn in the Water; and the other ſuddenly to fly up into the Air

TAKE two rocket-ſhells of equal dimenſions, fill one with a good charge quite full; the other charge bore and tie to a ſtick as uſual; the former you glue upſide down with a little glue to the middle of the latter, and towards the end tie it round with a cord, which is ſomewhat longer than the rocket ſtick; to the end thereof faſten a ring, and in that a leaden ball, which is to keep both rockets in a due poſition on the ſurface of the water; through this ring put the end of the ſtick, which is provided with a croſs that is ſomewhat wider than the diameter of the ring, and keeps the cord, ring and ball under water: the communication of the fire muſt be made below the rockets, by a ſmall pipe, fill'd with meal-powder very ſecure, ſo as to keep it from the water; for as ſoon as the water-rocket is burnt to the end, the fire will make its way through the pipe, and the land rocket will diſengage itſelf by its force from the caſe of the other, and leave the cord, ring and ball, behind in the water. See Fig. 26.

a the land-rocket, *b* the water-rocket, *c* one end o the cord tied to the water-rocket, *d* the other end of the cord faſtened to a ring and leaden ball, *e* the wire that keeps back the ring, *f* the little pipe for the communication of the fire.

How to make Water-rockets, Water-brands, Water-cats, Water-ducks, &c. that turn themſelves in the Water.

THE caſes for the water-brands and alſo their ſticks muſt be made ſomething longer than ordinary, and b fill'd with a compoſition of courſe coal-duſt, ſmall rub'd tan

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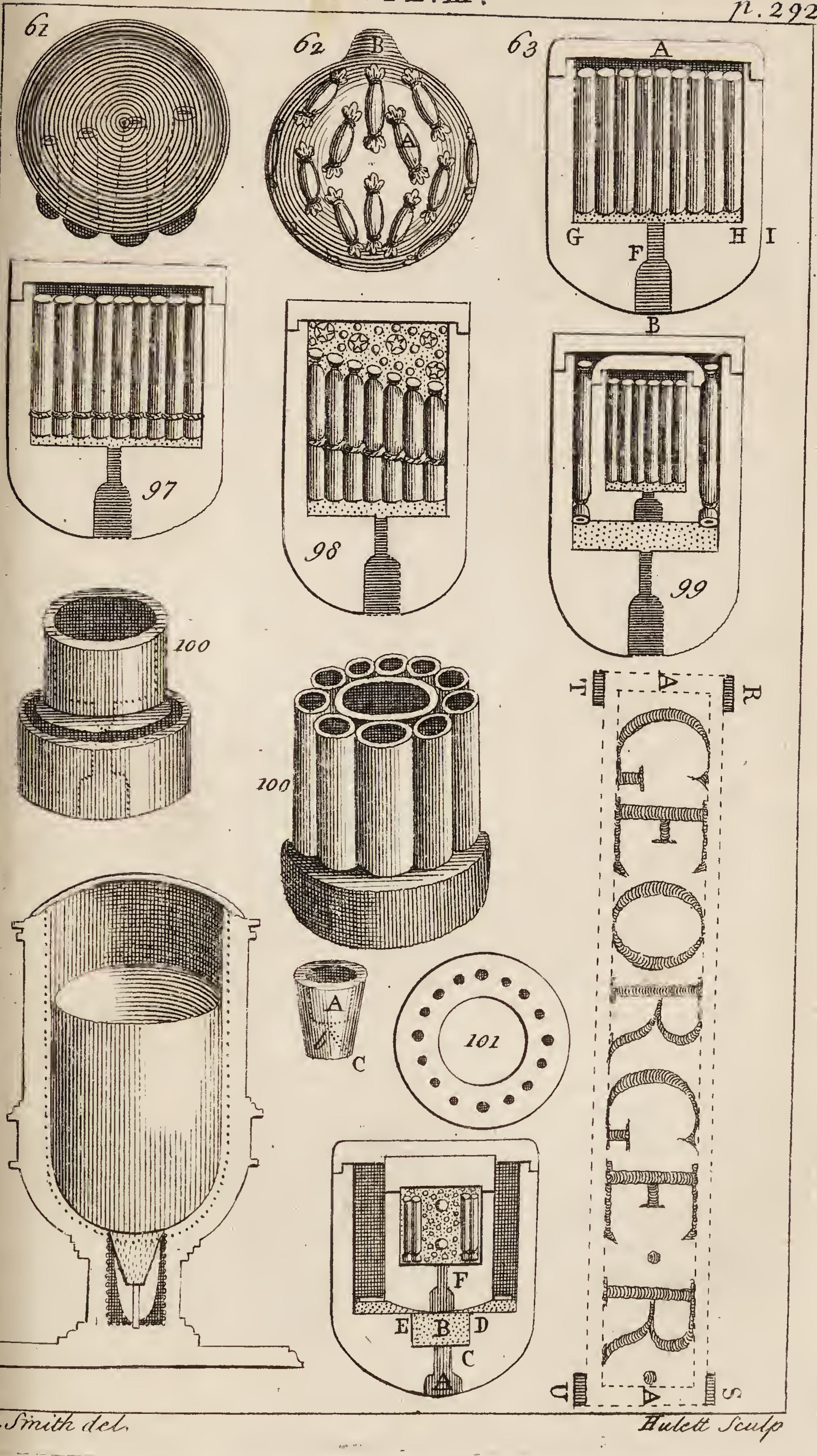
PLATE. III.

p. 292.



Smith del.

Hulett Sculp

ners bark or ſaw-duſt, but in the ſame method as ſky-rockets. The whole caſe is to be nine or ten diameters long, and muſt be divided into five equal parts, and be charg'd two fifth's full of compoſition; upon this charge a report of a quarter high, and upon that fine iron flakes, in order to ſink it, then cover it with paper and draw it together with a cord; the charge is lifted up a little in the neck, and ſupplied with brandy dough, or meal-powder moiſtened with brandy, then glew'd over with paper; and having fix'd a wooden ſwimmer below the neck, it is dip'd in wax and pitch, and then it is ready.

Water-crackers which turn in the water are thus prepared.

The caſe is made nine or ten diameters long, the neck is drawn quite cloſe, and charg'd with meal-powder almoſt half full; upon this a partition is made with a hole in it, then put corn'd powder for a report; upon that is placed another partition; the reſt is fill'd with meal-powder, and the end tied cloſe, and the paper cut ſhort at both ends: when theſe crackers are to be fired, make a touch-hole at the end of both, reverſed, and having filled them up with meal-powder, and cover'd them well with brandy dough, you may fire and fling them into the water having before dipt them in melted wax, or pitch.

It it to be obſerv'd, that to the water-cat-caſes, one may proceed thus from one ounce to half pound crackers; but if larger, they are too heavy, and will not ſo ſoon turn up again in the water, till ſome parts of them are conſumed; wherefore to remedy this, put in the caſe firſt three meaſures of charge, upon this put a little corn powder, then again two meaſures of charge and a little corn-powder, and proceed thus as far as the report; upon the charge is placed a partition of wood, with a hole in it, on that a report of good corn-powder, then tie it cloſe: further, open it a little, putting ſome meal-powder to it mix'd with brandy; and when you would uſe it, anoint it all over with either greaſe or linſeed oil. The water-crackers or divers are commonly ramm'd in one, one and a half, and two ounce caſes, ſtratified in the manner juſt mentioned, taking two meaſures for each lay of water-cat-charge, and a little corn powder between each.

There are other ſorts of rockets, that may be repreſented ſwimming on the water: theſe are made in the ſame manner as the one, or one ounce and a half rockets, bor'd one third in the charge, then put into a paper cylinder with two ſmall wooden heads, or baſis, having a hole bored to the centre of each: the height of this cylinder muſt be equal to half of the rocket, and the hole through the centre of each head fitted exactly to the rocket; when you have fixed every thing to a nicety, put it into melted wax or pitch, and when cold, you may fire and fling it into the water. See Fig. 27, 28, 29.

You may alſo put theſe ſorts of rockets into a paper cone, and faſten it to the neck of the rocket; or elſe in a bladder full of wind, which, inſtead of dipping in melted wax, do over with a mixture of four parts of linſeed oil, two parts of bole armoniac, one part of white lead, and half a part of aſhes. Vid. Fig. 30, 31.

One may mix along with the reports of the rockets certain ſparks and ſtars intermix'd with meal, and corn-powder; to this is fix'd an iron or wooden tube B, from each end of this goes another ſmaller tube C D, all having communication with one another, alſo with the compoſition, and the ſtars, *&c.* Theſe are fill'd with meal-powder, cover'd over with paper, dip'd in wax or pitch, and a counterpoiſe A being fix'd below, it is fired. As ſoon as the compoſition is burnt down to the cap, it is conveyed through the ſmall tubes *a a* to the lower part, where beating out the partition, it diſperſes the powder, ſtars, *&c.* to the air. See the figure.

Charges for Water-Rockets.

MEAL-powder ſix ounces, roſin one ounce, charcoal three quarters of an ounce, ſaltpetre one ounce, corn-powder one ounce.

Saltpetre one pound, brimſtone eight ounces, meal-powder eight ounces, and charcoal four ounces and a half.

Saltpetre four ounces, brimſtone three ounces, and charcoal three quarters of an ounce.

Meal-powder one pound and a half, ſaltpetre half a pound, brimſtone four ounces and a half, charcoal ſix ounces, coarſe coal two ounces and a half, and lead, for ſinking, one ounce.

Meal-powder two pound, ſaltpetre one pound, brimſtone ten ounces, charcoal eight ounces, coarſe coal three ounces, ſinking lead one ounce and three quarters, for three quarter ounce rockets.

Meal-powder two pound, ſaltpetre four pound, brimſtone one pound, charcoal four ounces, coarſe coal three ounces, tanners duſt two ounces and a half, ſaw-duſt two ounces, glaſs-powder one ounce, ſinking lead one ounce and three quarters, for one pound rockets.

Meal-powder half a pound, ſaltpetre three quarters of a pound, charcoal five ounces, ſaw-duſt half an ounce, and a quarter of an ounce of fine chop'd cotton, boil'd in ſaltpetre lee.

Charges for Water-crackers.

MEAL-powder two pound and a half, ſaltpetre one pound and a half, brimſtone ten ounces, charcoal eleven ounces, coarſe coals nine ounces, the ſinking is, to two ounce crackers, a quarter of an ounce of lead.

Meal-powder two pound and a half, ſaltpetre two pound and a half, brimſtone one pound five ounces, ſaw-duſt twelve ounces, charcoal three quarters of a pound, coarſe coals half a pound, the ſinking a quarter of an ounce.

Meal-powder four ounces, ſaltpetre five pound, brimſtone two pound and three quarters, tanners duſt one pound and a half, charcoal one pound, coarſe coals two pounds and three quarters, glaſs-duſt four ounces, lead three quarters of an ounce.

Charges for tumbling Water-crackers.

MEAL-powder one pound, ſaltpetre one ounce, and charcoal one ounce and a half.

Meal-powder one pound, ſaltpetre eight ounces, brimſtone three quartes of an ounce, and charcoal one ounce and three quarters.

Meal-powder three quarters of a pound, charcoal four ounces; for one and a half or two pound rockets.

Charges for Water-cats.

MEAL powder two parts, ſaltpetre four parts, brimſtone one part, coarſe coals two parts, ſaw-duſt two parts, and antimony three parts, moiſten'd with linſeed oil.

Meal powder two ounces and a half, ſaltpetre three ounces and a half, brimſtone two ounces and a half, and antimony half an ounce.

Meal-flower one pound; ſaltpetre two pound, brimſtone one pound, and charcoal one pound,

Saltpetre fifteen ounces, brimſtone five ounces, ſaw-duſt eight ounces, and antimony two ounces.

Some general Remarks upon Rockets.

1. YOUR rockets muſt have their proportionable height, according to the diameters of their orifices.

2. Their necks muſt be drawn or choak'd firm, and to prevent the cord giving way, they muſt be glued over.

3. Prepare your compoſition juſt before you want it.

4. Let it neither be too damp nor too dry, but ſprinkle it over with a little oily ſubſtance, or a little brandy.

5. When you drive your rockets, put always equal quantities of compoſition in your caſes at a time.

6. Carry with your mallet an even and perpendicular ſtroke, when you charge your rockets.

7. The cavity muſt be bored upright and perpendicular, exactly in the middle of the compoſition.

8. Bore your rockets juſt before you uſe them; then handle them carefully, leaſt their form ſhould be ſpoiled.

9. Let the ſticks and rods be well proportioned, ſtrait and ſmooth.

10. Put your rockets, when compleated, in a place that is neither very damp nor dry.

11. Let moſt of your rockets have at top a conic figure, by that means they will the eaſier ſhoot through the air.

12. Avoid, if poſſible, a damp, foggy, rainy or windy night, to play your rockets.

Defective Rockets are chiefly diſcovered by the following Obſervations.

1. WHEN they are fired and in mounting two or three perches, they break and diſperſe without peforming their proper effects.

2. When they remain ſuſpended on the nail, and waſte away ſlowly without riſing at all.

3. When they form an arch in their aſcent, or a ſemicircle, and return to the ground before their compoſition is burnt out.

4. When they mount in a winding poſture, without an uniform motion.

5. When they move on ſlowly and heavy.

6. When the caſes remain on the nails, and the compoſition riſes and diſperſes in the air.

More of theſe vexatious accidents will ſometimes fruſtrate the hopes of a young practitioner, but as the above are the principal ones, he muſt endeavour to avoid them in his firſt beginning.

Of

Of Rocket-Flyers, and the manner of charging them.

THESE are of two ſorts, namely, the ſingle and double, the latter are made after the following manner:

Have a nave or button turn'd, the dimenſion of three inches, together with two knots upon it, perpendicular one againſt the other, of an inch and an half long, and ſo thick that both rocket caſes may fit over them; there muſt alſo be a hole of the third of an inch in the centre of the nave, for the iron pin to go through, on which it is to fly; after this take two rocket caſes, of equal dimenſions, which are choak'd quite cloſe at the neck, and glewed: ram in the charge ſo far as to leave only room to fix them on the two knobs upon the nave: this done, bore into both rockets, near the cloſed up necks, ſmall touch-holes, and one more near the pin, in that which is to burn firſt; from this hole, carry a little pipe to the hole near the neck of the other rocket, having firſt fill'd it with meal powder, that when the rocket is almoſt burnt out, the ſecond may be lighted by the firſt. The three touch-holes ſtand in one row, and you may on the other ſide fix a couple of reports, which will cauſe a ſwifter motion.

The ſingle flyers are made with more eaſe, the neck in theſe muſt not be tied cloſe as in the former, but they muſt be fired in that place; but theſe don't turn ſo well as thoſe that are made double, the figures hereof will give you a fuller idea to manage them. See Fig. 33, 34.

Of Fire-Wheels.

OF theſe there are three ſorts, *viz.* ſingle, double, and tripple; ſome of their fells are of a circular form, others an hexagon, octogon, or decagon form, ſome like a ſtar without fells; ſome, and the moſt of them, are made to run perpendicular to the earth; others horizontal; all may be ordered ſo as to ſerve either on land or water.

The fire-wheels that are to be uſed on land, turn upon an iron pin or bolt, drawn or ſcrewed into a poſt. The nave is turn'd of cloſe and firm wood, in which the joiners glew the ſpokes, according to the number of the fells, which muſt be carefully joined together; then have a groove hollowed round, ſo deep that the rocket or caſe may be about half lodg'd therein. See Fig. 35.

The double wheels muſt have their fells turn'd ſtronger and wider, with a groove for the rockets, not only at top, but alſo on one ſide thereof: plying the necks of the rockets at top to the right, and thoſe of the ſides to the left hand. Vid. Fig. 36.

A tripple wheel has a groove at top, and one at each ſide; the matches are laid from one groove and rocket to another, with ſmall pipes, fill'd with meal-powder: you may alſo make a tripple wheel on a long nave, and obſerve the placing of the rockets on each, contrary one to the other; and the communication you are to make with ſmall pipes, which, after they are fix'd, you are to cover and glew over with paper. Vid. Fig. 37.

Your rockets being ready and cut behind a little ſhelving, bore them; the firſt three diameters of its orifice, the ſecond two and three quarters, the third two and a quarter, the fourth two diameters, the fifth one and three quarters, the ſixth one and a half; the ſeventh one and a quarter; the eighth one diameter; always the latter ſomething ſhorter than the preceeding; after this they are prim'd with meal-powder work'd up with brandy, and when dry, glew'd in the above deſcrib'd grooves; you muſt bear the firſt fir'd rocket's neck up above the reſt, underlaying it with a tin plate, or any thing elſe, the ſame you muſt obſerve in the head of the laſt fired one, wherein you put the charge of a report; you may alſo glew on every end of the rockets, a report of paper, with ſmall pipes of copper, or gooſe-quills, which are fix'd one end in the ſide of the rocket, and the other in the report. When all is dry, then you may cover your wheel on one or both ſides, with linnen or paper, in what form you would have it.

The horizontal wheels, are made like the others with fells, or out of one entire piece; their grooves are furniſhed with rockets, and their plane garniſhed with crackers. Vid. Plate I. Fig. 38.

A fire wheel which is to whirl horizontally in the water muſt be thus ordered.

Take a pretty large wooden diſh or bowl, that has a broad flat rim, See Fig. 39. alſo a ſmooth dry board, ſomething larger than the diſh, and form'd into an octagon; in the middle of this board make a round hole, that will hold a water-ball, ſo that one half be received in the diſh, and the other half riſe above the ſurface of the board; nail this board upon the rim of the diſh, and fix the ball in the middle, tying it faſt with wire; then glew your rockets in the grooves which are made round the edges of the board, laying them cloſe to one another, ſo that ſucceſſively taking fire from one another, they may keep the wheel in an equal rotation. You may add, if you pleaſe, on each ſide of the wheel, a few boxes, fill'd with crackers or cartouches, erected perpendicular, and alſo fix double and ſingle crackers, following in a range, one after another, for two or three fires, or as many as the extent of the wheel will admit.

For your private fuzees, obſerve that you conduct one from the rocket, which is to be fix'd to the compoſition of the ball in a channel.

Fill theſe channels with meal-powder, and cover them cloſe with paper: alſo lay a train of fuzees of communication from the rockets to a cartouch, and from that to the reſt. See Fig. 40.

Laſtly, when all is ready and covered, dip the whole machine into melted pitch, and ſecure it from the injury of the water: the ball is fired firſt, and when lighted, you place it gently on the ſurface of the water, and then fire the rocket.

To try a fire-wheel, firſt weigh one of the rockets, tie it to a fell with cord, and according to that weight, fill little long bags full of ſand, tying them likewiſe on the reſt of the fells; then hang the wheel on an iron pin, fire the rocket, and if it turns the wheel, then you may aſſure yourſelf it will be compleat when finiſh'd.

Wheels form'd like ſtars, are to have their ſpokes fix'd upright in the nave, like other wheels, only with grooves on one of the ſides of each, wherein you glew the rockets, at the bottom of each rocket is made a little hole, from whence the fire is convey'd through little pipes, fill'd with meal-powver up to the next, and ſo round; then cover it with linnen cloth or paper in the ſhape of a ſtar, and place it on the iron axis.

Obſerve that all the rockets uſed in fire-wheels, have their necks tied cloſe, leaving only a ſmall conveyance from one rocket to another; the laſt of all muſt be well ſecured below, where you may place a ſtrong report of corn-powder. See Fig. 40.

Charges for Fire-flyers and Wheels, of four, five, and ſix Ounce Rockets.

MEAL powder three pound, ſaltpetre two pound, charcoal five ounces, and ſea-coal three ounces.

Meal powder fourteen ounces, ſaltpetre ſix ounces, charcoal three ounces and a half, brimſtone three ounces, and ſea-coal three ounces.

Meal powder fifteen ounces, ſaltpetre ſix ounces, brimſtone three ounces, and charcoal three ounces.

Saltpetre five pound, brimſtone three quarters of a pound, charcoal one pound four ounces.

Theſe charges are bored a little with a round bodkin.

Meal powder two pound, ſea-coal eight ounces, and charcoal ten ounces.

Meal powder three pound, brimſtone eight ounces, and charcoal ten ounces.

Theſe charges may be uſed for tripple wheels, and muſt be bored one third with a bodkin.

For Wheels of one Pound Rockets.

MEAL powder ſix pound, ſaltpetre three pound, brimſtone one pound ſeven ounces, charcoal two pound nine ounces, and tanners duſt one ounce.

The bore muſt be an inch and an half.

For Wheels of one and a half, and two Pound Rockets.

MEAL powder ſix pound, ſaltpetre three pound and a half, brimſtone one pound and a half, charcoal two pound three quarters, and ſaw duſt one ounce and a half.

The firſt rocket in the wheel is in length two diameters and a half of its orifice.

For Wheels of three and four Pound Rockets.

MEAL powder nine pound, ſaltpetre one pound and a half, brimſtone one pound two ounces, and charcoal three pound four ounces.

The firſt rocket is bored but one and a half of its diameter.

To make ſingle and double CARTOUCHES, or BOXES, TUBES, STARS, SPARKS, *&c.*

WHEN ſome hundred boxes or cartouches, are adjuſted and fixed in machines of great fire-works, they afford among the towring rockets great delight to the ſpectators. Theſe boxes are made either of wood, paſte-board, or copper; and are charged and proportioned according to their ſtrength, with the charge and compoſition that is deſigned for them. If made of wood they muſt fit exactly, and receive each other, ſo as to ſeem but one continual piece; and if paſteboard, you muſt glue on a foot at bottom, of a hand high, to each of them: the inſide of theſe machines muſt exactly fit and correſpond with the outſide of the cartouches themſelves, and be ſo contrived as to ſlip into one another.

The engine, Fig. 42, is very proper for the conſtruction of thoſe boxes, one repreſents the bench, and the other the cylinders, upon which, (having greaſed them firſt over with ſoap,) you faſhion your boxes, juſt as you think proper, by paſting one thickneſs of paper upon another, and fixing a handle to the end of the cylinder.

Having formed them, put them to dry in a moderate heat, too great a heat will ſhrivel them up; when dry, take one after another off the cylinder, and immediately clap round wooden bottoms, the edges being firſt done over with glue, into them, and ſprig them on the outſide to make them ſecure.

The ſingle boxes are to be charged in the follow manner:

1. Put in ſome corn-powder.

2. Upon that charge fix a round paſte-board, well fitted to the concave ſide of the box, which has five or ſix ſmall holes, and is on both ſides laid over with meal-powder tempered with brandy.

3. Put upon the paſte-board a little meal-powder, and upon that well pierced crackers, ſo as to ſtand with their necks downwards: the principal rocket is put in the middle, with the neck downwards open at both ends, ſo that being lighted above and burning down it may fire the reſt of the crackers, which are blown up in the air by the corn-powder.

4. The empty ſpaces betwen the large fire-caſe and the crackers are carefully filled up, and the cartouch is ſtuffed at top with tow, or elſe with ſawduſt boiled in ſaltpetre lee.

5. The cartouch is covered with a cap, which is glewed very cloſely thereon, and for the great caſe reaching out of the cartouch; make in the middle of the cap a hole, through which it is put, and cloſe the opening by glewing ſome ſlips of paper round it. The fire-caſe is looſe, covered with a paſte-board cap.

Double Boxes, or Cartouches.

IN Fig. 43, is exhibited the conſtruction of a caſe, called a double one; to enlarge on the deſcritipon thereof ſeems to be needleſs, only obſerve, that the bottoms of the upper boxes, ſerve for the covers of the lower, a hole being made, through which the compoſition of the lower box is fired, after the upper rocket has forced away the empty box, which already has diſcharged its load: The upper box you cover as has been ſhewn above. If there are more than two cartouches upon one another, they are called Burning Tubes, which when fired ſhorten by degrees, the cartouches following one another till all are fired; ſome are intermixed with artificial globes, and ſeveral other fancies, which afford great pleaſure to the ſpectators

Theſe boxes, or cartouches, are placed in long caſes made for that purpoſe. The vacancies about the cartouches may be filled up with ſand. See Fig. 44.

Another Sort of Fire Tubes.

ARE made of ſolid, hard and dry wood, of what height and thickneſs you think proper, bore the middle of the wood one third or a quarter of its diameter, after which divide the whole height into equal parts, each exactly correſponding with the sky-rockets you deſign to fix upon them, but rather a ſmall matter ſhorter; all theſe diviſions are cut ſloping downwards, except the uppermoſt, which muſt run out in a cylinder. On the rims of each of theſe diviſions make a groove all round, of about a fingers breadth; in theſe grooves bore ſmall holes, by which the fire may be conveyed through pipes from the cavity of the tube, to light the rockets that ſtand behind the paper cartouches, which muſt be made ſecure to the wood, leaſt they ſhould fly up along with the rockets.

The conſtruction of the hollow tube in this and other ſuch like tubes is expreſſed in Fig. 45. A, the fire-ſtars and ſparks, interſperſed with corn-powder. B, a box filled with paper or crackers. C, a fire-ball or water-globe, which of them you pleaſe. D, another box filled with crackers. The hollows between theſe fires are filled up with corn-powder, to blow up the globes and boxes one after another.

The ſtars and ſparks made uſe of on this occaſion are prepared in the following manner.

Take of beaten ſaltpetre five pound and a half, meal-powder two pound four ounces, and brimſtone one pound twelve ounces.

Meal powder three pound, ſaltpetre ſix pound, brimſtone one pound, camphir half an ounce, tanners bark two ounces, or elſe ſaw-duſt; all finely ſifted and moiſten'd with linſeed oil.

Meal powder one pound, ſaltpetre four pound, brimſtone half a pound, and pounded glaſs ſix ounces, moiſtened with linſeed oil.

Saltpetre half a pound, brimſtone two ounces, antimony one ounce, and meal powder three ounces.

Saltpetre half a pound, brimſtone three ounces, antimony one ounce, and iron file-duſt half an ounce.

Saltpetre two pound, meal powder ten pound, and brimſtone one pound.

Saltpetre one pound, brimſtone half a pound, meal powder three ounces, and antimony one ounce.

Saltpetre one pound, ſulphur two ounces, powder of yellow amber one ounce, crude antimony one ounce, meal-powder three ounces.

Sulphur two ounces and a half, ſaltpetre ſix ounces, fine meal-powder five ounces; frankincenſe in drops, maſtick, mercury-ſublimate, of each four ounces; white amber and camphir of each one ounce, antimony and orpiment of each half an ounce.

Theſe ingredients being well beaten, and ſearced thro' a ſearcer, muſt be ſprinkled over with a little glew or gum water, and form'd into little balls, of the bigneſs of a ſmall nut, then dry'd in the ſun, or near a fire, and lay'd up in a dry place, to be ready, on occaſion, for playing off with fireworks. When you uſe them, wrap them up in tow.

The following Stars are of a more yellowiſh Caſt, inclining to White.

TAKE four ounces of gum-tragacant, or gum-arabick pounded and ſifted through a fine ſieve, camphir diſſolv'd in brandy two ounces, ſaltpetre one pound, ſulphur half a pound, coarſe powder of glaſs four ounces, white amber one ounce and a half, orpiment two ounces; incorporate them, and make balls of them, as directed before.

Sparks are prepared thus.

TAKE ſaltpetre one ounce, ditto melted half an ounce; meal-powder half an ounce, and camphir two ounces;

ces; having melted theſe things by themſelves, (when you uſe them) put together in an earthen pot, pour on them water of gum tragacant, or brandy that has had gum arabick, or gum tragacant diſſolv'd in it; that the whole may have the conſiſtence of a pretty thick liquid; this done take one ounce of lint, which before has been boil'd in brandy, vinegar, or ſaltpetre; when dry, throw it into the compoſition, mix and ſtir it about, till it has ſoak'd it up; then roll them up in pills about the bigneſs of great pins-heads, and ſet them to dry, having firſt ſprinkled them with meal-powder.

Some of theſe pyramidical tubes and fire-works, are now and then fired in large rooms, upon grand entertainments in miniature, wherein are enploy'd odoriferous pills, and other ingredients, that have a fragrant ſmell; theſe pills are commonly compoſed of *Storax Calamita*, benjamin, gum-juniper, of each two ounces; *Olibanum*, maſtick, frankincenſe, white-amber, yellow amber, and camphir, of each one ounce; ſaltpetre three ounces; lime-tree-coal four ounces; beat theſe ingredients very fine, pulverize and incorporate them together; and moiſten it with roſe-water, wherein before you have diſſolv'd ſome gum-arabick or gum-tragacant, you may form them into pills, and dry them in the ſun, or before a fire.

Single Tubes, or Caſes.

ARE only filled with compoſitions, and to the outſide are faſtened ſome crakers, ſerpents, or cartouches; theſe caſes being generally round and uniform, like a cylinder, you are to trace out a winding line from the top to the bottom, on which cut holes to the depth of two or three inches, See Fig. 46. B and C. Into theſe holes contrive to fix paper caſes with wooden bottoms, wherein you may put any ſort of rockets you pleaſe, as you ſee in A and E; but take care you provide little holes, to lead from the great tube to the corn-powder under your rockets.

Another fire-tube is delineated Fig. 47. This is ſurrounded with cartouches, diſpoſed in a ſerpentine order, like the firſt, which are glewed and nailed as ſecure as poſſible; out of theſe are diſperſed great numbers of ſquibs; as for the reſt, they have nothing but what is common in others.

Another Fire Tube.

THE circumference of this cylinder is by a cord divided into a certain number of equal parts, and being brought into a poligonal figure, cutting away the convex part, it is brought into angles.

Then bore the plain ſides with a number of holes perpendicular, ſo as to penetrate obliquely to the great boring in the middle; into theſe holes thruſt crackers, ſquibs, or ſerpents. See Fig. 48.

Fig. 49 exhibits a tube, whoſe length is ſix diameters of its thickneſs. The cylinder being divided round the rim into ſix parts, then ſubdividing each of thoſe into ſeven parts, reſerve one of them for the liſt, between each of which make channels, which being ſix in number, place little mortars of the ſame dimenſions therein.

The mortars muſt be turned of wood; bore the bottoms and add a chamber to them, as you ſee at E, each chamber muſt be one third or one half of the depth of the fluting, and the breadth one ſixth only. Theſe chambers are deſigned to hold corn powder.

Secure thoſe mortars on the outſide with ſtrong paper caſes, and nail them faſt in the hollow channels, whoſe cavity they are to fit exactly; their length may be doubled to their breadth; each mortar muſt contain a globe made of paper, with a woden bottom, and their chambers muſt be charged with corn powder.

Theſe mortars fix in a ſpiral line, one only in each fluting, with iron ſtays, and bind the middle with an iron plate, faſtened on each ſide of the interſtices; but before you fix the mortars, you muſt not forget to pierce little holes in the tube, and to fix the touch-holes of your mortars exactly upon them, priming both with meal powder. Every thing relating to this may be plainly conceived in the figure, where A and B deſcribes the mortars, and C the globe or cartouch.

Of Salvo's.

THESE, in fire-works, are a great number of ſtrong iron reports fixed either in a poſt or plank, and with a fire diſcharged at once.

Charges for Cartouches, or Boxes.

MEAL powder ſix ounces, ſaltpetre one pound eight ounces, brimſtone four ounces, and charcoal four ounces and a half.

Meal powder fourteen ounces, ſaltpetre five ounces, brimſtone two ounces, and charcoal three ounces.

Meal powder one pound, ſaltpetre three quarters of a pound, brimſtone four ounces and half, tanners bark or ſaw-duſt two ounces, and charcoal four ounce.

Charges for Fire Tubes.

MEAL powder ſix pound, ſaltpetre four pound, charcoal two pound, roſin half a pound, tanners bark five ounces, moiſtened with a little linſeed oil.

Meal-powder three quarters of a pound, ſaltpetre four pound, brimſtone ten ounces, and ſaw-duſt four ounces. This charge may be uſed dry.

Meal-powder five pound, ſaltpetre three pound, charcoal one pound ſix ounces, roſin three quarters of a pound; not moiſtened.

A Preſervative for Wood againſt Fire.

THIS being a neceſſary article in the execution of fire-works, it will not be improper to ſet it down in this place.

Take brick-duſt, aſhes, and iron-filings, of each an equal quantity; put them together in a pot, pour glew-water or ſize upon it, then put it near the fire, and when warm ſtir it together. With this ſize waſh over your wood-work, and when dry repeat it, and it will be proof againſt fire.

The Manner of preparing and making Letters and Names in Fire-Works.

BURNING letters may be repreſented after ſeveral methods.

Order a joiner to cut capital letters, of what length and breadth you pleaſe, or about two foot long and three or four inches wide, and an inch and a half thick; hollow out of the body of the letters, a groove, a quarter of an inch deep, reſerving for the edges of the letters a quarter or half an inch of wood. If you deſign to have the letters burn of a blue fire, then make wicks of cotton or flax, according to the bigneſs and depth of the grooves in the letters, and draw them leaſurely through melted brimſtone, and place them in the grooves; bruſh them over with brandy, ſtrew meal powder thereon, and again with brandy and thin diſſolved gum-tragacant, and on that ſtrew meal powder again; when dry drive ſmall tacks all round the edges of the grooves, and twiſt ſmall wire to thoſe tacks, that it may croſs the letters and keep the cotton or flax cloſe therein; then lay over it brandy paſte; ſtrew over that meal-powder, and at laſt glue over it a ſingle paper.

If you would have the letters burn white, diſſolve ſix pound of ſaltpetre, and add to it a little corn-powder; in that dip your wicks of cotton or flax. You may inſtead thereof uſe dry touch-wood, which cut into pieces of an inch thick; put them in melted ſaltpetre over a fire, let them lay therein till the ſaltpetre is quite ſoaked thro' the wood, after which mix powdered ſaltpetre with good ſtrong brandy; take ſome cotton, and with a ſpatula or your hands, work that, the ſaltpetre and brandy, together; then ſqueeze it out, ſtrew the cotton over with powder'd ſaltpetre, and thereof make wicks, having placed firſt the touch-wood in the grooves, lay the wicks over that and the vacancies about it, and then proceed to make it tight and ſecure, as has been directed above. See Fig. 40.

There is another method for burning letters without grooves, and this is done by boreing ſmall holes in the letters of about an inch diſtance, one from the other; the diameter of thoſe holes muſt not be above the eighth of an inch; into them put and glew caſes, ram'd with burning charges; but theſe letters do not burn ſo long at the others, except the charges are very long.

Another method for burning of letters is uſed, when they are form'd by a ſmith of coarſe wire, about a quarter of an inch thick; when this is done get ſome cotton ſpun into match-thread, but not much twiſted, to two yards of this take one pound of brimſtone, ſix ounces of ſaltpetre, and two ounces of antimony, melt theſe ingredients in a kettle, firſt the brimſtone by itſelf, and then the reſt altogether; when melted, put in the match-thread and ſtir it about, till it has drawn in all the matter; then take it out, and ſtrew it over with meal-powder, let it dry, and wind it about the white letters; faſten theſe upon a board, that has been well laid over with a preſervative to keep it from firing. When you have lighted one letter, all the reſt will take fire immediately.

Letters cut in a ſmooth board, which is made to ſlide in grooves of a cheſt are ordered thus; The lid of the box is made full of holes for diſperſing the ſmoak of the lamps, or wax-tapers, which are ſet behind, to illuminate the letters, behind the cut out letters is paſted oil paper of various colours, which, when the lamps are lighted, has a fine effect. By theſe means, various changes may be made, in repreſenting devices, names, coats of arms, *&c.* But this way is more practiſed on the ſtage in plays than in fire-works.

Charges for Burning Letters with Caſes.

MEAL-powder ſix ounces, ſaltpetre one pound, mix'd with *Potrolio* oil.

Meal-powder three quarters of a pound, ſaltpetre nine ounces, and brimſtone three ounces, mix'd up dry.

Meal powder five ounces, ſaltpetre ſeven ounces, brimſtone three ounces, and file-duſt half an ounce; moiſtened with linſeed oil.

To order and preſerve Leading-fires, Trains, and Quick-matches.

FIRE-works being of various kinds and inventions, it is impoſſible to aſſign certain rules for their ſeveral performances. But to ſay ſomething of what concerns a maſter's praiſe, it is to be obſerved, that great fire-works are not to be fired above once or twice at moſt; for it would not be deemed an artful performance to fire one cartouch after another; likewiſe the match-pipes, the moſt preferable of which are either iron, lead, or wood, and ſhould be ſtrengthened or cloſely twiſted round with the ſinews of beaſts, ſteeped in diſſolved *Feather-white*, and filled with ſlow charges, which ought to be well tried. Or elſe furniſhed with match-thread of *Stupinen*, dry and well prepared, and afterwards either joined to the grooves made in the boards, or only laid free from one work to another. The joinings of the pipes muſt be well cloſed and luted with potter's clay, ſo as to prevent the fire from breaking out; theſe pipes muſt alſo have little vent holes to give the fire air, or elſe it would be ſtifled, or burſt the pipes; but theſe holes muſt be ſo contrived, that the flame may vent itſelf in the open air, and at ſome diſtance from the works, ſo as to prevent touching them.

All burning matches are to be as diſtant from the machines as poſſible, to prevent accidents.

A particular direction for conducting your trains and fuzees, cannot be given, becauſe of the variety of poſtures, ſituations and contrivances of machinery; thoſe rules already given will be ſufficient for the ingenious; add to this the advantage a novice in this art, may gather from the ſufficient direction in this matter from the figures, which, with much care and induſtry, have been traced out for their information and benefit.

Charges for Fuzees, or Leading-matches.

MEAL-powder three ounces and a half, ſaltpetre four ounces, brimſtone one ounce and three quarters, and charcoal one ounce and three quarters.

Meal-powder three ounces, ſaltpetre nine ounces, brimſtone four ounces and a half, and charcoal half an ounce.

Meal-powder four ounces, charcoal half an ounce, and coarſe coal half an ounce.

Meal-powder half a part, ſaltpetre three parts, brimſtone two parts, and charcoal one part: this laſt is very ſlow.

Of Water-balls.

BALLS, in fire-works, are made of different faſhions, ſome are globular, ſome oval, ſome conical, ſome cylindrical, and others in the form of a pendant or drop.

The water-balls are commonly made of knitted cord-bags or of wood, thoſe made of bags are ſhaped like oſtriches eggs, and are

1. Fill'd with their proper charge.
2. The outſide is dip'd in glew, and wound about with hemp or flax, till it is a quartar of an inch thick thereon.
3. This ball is then coated over with cloth, and about the touch-hole is glewed over with a piece of leather.
4. The touch-hole is bored with a gimlet, and ſtop'd with a wooden peg.
5. At the botton of the globe pierce a ſmall hole thro' to the compoſition, in which faſten a ſmall copper-pipe, furniſhed with a paper report, together with a leaden balance; glew the report faſt to the ball, then dip the ball in melted pitch, open the touch-hole, and prime it with a quick burning charge.

Theſe balls keep a long time under water, before they riſe, and if a true balance is not obſerved in the lead, or the ball is overcharg'd, they will ſink to the bottom and burn out, therefore you muſt well obſerve, that when a water-ball without the balance is two pound weight, you muſt give it four, or four ounces and a half of lead, but if it weighs one pound and a half, balance it with three or three ounces and a half.

Water-balls or globes made of wood, which ſwim and burn upon the water without any further effect, are of two ſorts, *viz.* ſingle and double, the ſingle ones are made thus: have a hollow globe turn'd ſomewhat oblong, with a vent-hole, fill that with a good and approv'd charge, but not too cloſe, prime the end with ſome meal-powder, then glew a ſtopple in the hole, which muſt be thrice as thick, as the ſhell of the globe, in which beforehand the counterpoiſe is caſt of lead; when dry, make a hole at top, large enough for a two ounce cracker to enter, through this ram down the charge in the globe, and fill it quite full with the ſame compoſition; then glew it over with a paſte-board: and laſtly fix a ſmall copper pipe through the ſtopple, having boared a hole through it for that purpoſe; to the pipe faſten a paper report, when this is done dip the whole in pitch: theſe are call'd ſingle water-globes. Both ſort of globes are, for the better ſecurity, twiſted and tied round with ſeveral rows of ſtrong packthread.

Double water-globes are ſuch which after one is fired, diſcharges another. Theſe have chambers at bottom which are fill'd with gum-powder; on theſe put a cover of thick leather, which has ſeveral holes in the middle, and goes cloſe to the ſide; on this ſtrew meal-powder, and place thereon a fire-globe, which is charged. Fig. 52. will demonſtrate the conſtruction with more eaſe than a long leſſon; obſerve,

1. That the little chamber at bottom ought to be the fifth of the breadth of the whole globe, and that its height be one and a half thereof.

2. That the water-ball B, ſhould be encompaſs'd with a water-ball compoſition, as you ſee by H.

3. The partition C is for this purpoſe, that when the powder in it ſhall have the fire conveyed to it through the pipes E F G, it may with more force blow up the ball, in the body of the firſt; this taking fire at the hole D, will burn upon the water for ſome time, and then, to the aſtoniſhment of the ſpectaters, on a ſudden, it will blow up the ball that was in it.

4. You muſt be very careful to ſecure the piece of leather or board that covers the little chamber, leaſt it ſhould be blown up by the compoſition of the greater globe, before it is all burn'd out.

How to charge a Water-globe with many Crackers.

TAKE, for this purpoſe, a ſingle water-globe, which may be round or of an oval form, fill the ſame with the compoſition hereafter mentioned. Hollow the outſide thereof in ſeveral places, to the ſize of your reports or crackers, which are to be fix'd in them; to each of the crackers belongs a ſmall copper tube, fill'd with meal-powder, which are to be fitted to the ſmall holes in the flutings, in the manner as expreſſed in the print, where Fig. 53. A are the flutings, B the little holes for the fuzees, C the upper orifice for priming, D the hollow ſtopple, through which the ball is primed, E the form of the crackers, which are to be fix'd in the flutings, F little fuzees belonging to them.

How to prepare a Water-mortar, or Water-pump with ſeveral Tubes.

TAKE ſeven wooden tubes, wrap them about with cloth that is either pitch'd or dipp'd in glue, twiſting them round very tight with packthread. Their height, thickneſs and diameter you may order as you think proper, only allowing the middlemoſt a greater height than the reſt; bind them together in one cylindrical body; to the bottom fix a round board with nails, and then with ſtrong glew ſtop up all the crevices to prevent the air getting to the compoſition: this done fill the tubes according to the order repreſented in Fig. 54. Firſt pour into each tube, a little corn-powder, about half an inch high; upon that put a water-ball A, upon that a ſlow compoſition; then again corn-powder; upon which put a water-globe fill'd with ſquibs, as you ſee in B, on that again a ſlow compoſition, then corn-powder, ; and then a light ball, as may be ſeen in C, over this put a third time a ſlow compoſition on corn-powder, as before, which you muſt cover with a wooden cap; on this fix running rockets, not too cloſe, but to leave room enough between for a wooden caſe fill'd with a water compoſition; the remainder of the tube fill with a ſlow charge; and cloſe it up. Your tubes being all fill'd in this manner, get a ſquare or round piece of plank, with a round hole in the middle, large enough to receive the ends of all the tubes, which cover cloſe, to preſerve the powder and compoſition from being wet, this float-board is mark'd with the letter D, Fig. 55. Thus prepared, dip it in a quantity of tar, or melted pitch, then put the rocket E, or a ſmall wooden tube fill'd with a ſtrong compoſition that will burn on the water into the orifice of the middle tube ; the compoſition of which ſhould be more ſlow than of the reſt.

If you would have the tubes take fire all round at once, you muſt pierce the ſides of the great one with ſmall holes, correſponding with thoſe in each of the other tubes ; by this means the fire may be convey'd to all of them at once, and conſume them equally and at one time ; but if you would have them burn one after another, you muſt cloſe them well up with paſteboard, and to each tube fix a fuzee of communication, fill'd with meal-powder or a ſlow compoſition, thro' which the fire may be convey'd from the bottom of that which is conſumed, to the orifice of that next to it, and ſo on ſucceſſively to ſuch as have not been fired.

How to Charge a large Water-globe, with ſeveral little ones, and with Crackers.

HAVE a wooden cylinder made, let the orifice thereof be at leaſt one foot diameter, and its height one and a half ; let there be a lodge or chamber at bottom to hold the powder, which muſt be confin'd therein, by a tampion or ſtopple joined to a round board, fitted exactly to the inſide of the globe, through the middle of the ſtopple muſt paſs an iron tube fill'd with meal-powder ; then prepare ſix water-balls, or more if you think fit, ſo that when all are ſet together in the circumference of the globe, they may fill up that circle ; each of theſe balls muſt be provided with an iron-fuzee in its orifice, fill'd with meal powder. Having charged the chamber of the globe with corn-powder, let down the forementioned board with the ſtopple upon it, then range the ſix water-balls, cover them with another round board, that has ſix little round holes, correſponding with the ſix iron fuzees of the balls, and which muſt a little ſurmount it. This laſt board ſpread over with meal and corn-powder mix'd together, and upon it you place as many rockets as the globe can hold : in the midſt of theſe you fix a large rocket, into whoſe orifice the iron tube may enter, which is the ſame you ſee in E, Fig. 56.

This tube muſt have holes drill'd all round the plane of the 'foreſaid partition or board, to the end that the fire having a communication through them, it may reach the running rockets, and at the ſame time fire the water-balls, whoſe tubes riſe out of the board, and from thence, after having penetrated down to the chamber below, it may blow up the whole into the air, and make a great noiſe. See the figure, where A points out the ſix water-balls, B the great rocket in the middle of the running ones, C the chamber for the powder, D a communication, or the iron pipe, to convey the fire to the paper cracker, F the globe, which having been adjuſted after the manner directed, cover it cloſe round, dip it in tar, to preſerve it from the water.

To prepare the Water Bee-hive, or Bee-ſwarm, both ſingle and double.

THE ſingle bee-ſwarm is thus prepared. Have an oblong globe turn'd, whoſe length is two diameters of its breadth, or proportioned to the height of your rounding rockets, which place round the wooden tube marked with A; this muſt be of an equal height with the globe, and be fill'd with a compoſition of three parts of powder, two of ſaltpetre and one of brimſtone; at the lower end of the globe fix a paper cracker C; the letter D is a counterpoiſe of lead, through which you convey a little pipe or fuzee, to communicate with the charge in the wooden tube; at top fix a round board for a balance; F two little holes which convey the fire to the charge for blowing up the rockets. See Fig. 57.

How to prepare a Water-globe on the outſide with Running-Rockets.

GET a wooden globe perfectly round and hollow, bore on the outſide ſeveral cavities, ſufficient to receive running-rockets, leaving a quarter of an inch between the extremities of them, and the compoſition within the ball; then bore the wood, left between each, with a ſmall gimlet, fill them with meal-powder, then put in your rockets; cloſe the top of the globe with a wooden cylinder, that has a hollow top, with a touch-hole to receive the priming, the bottom ſtop with a ſtopple, which likewiſe has a conveyance to the craker that is commonly fix'd beneath it; between which and the ſtopple fix alſo a leaden counterpoiſe, to keep the whole upright in the water. See Fig. 58.

To prepare Water-globes with ſingle or double aſcending Rackets.

FOR the firſt ſort have a globe turn'd with a tube in the middle, half its diameter wide leaving two inches for the placing of ſolid wood at bottom; round this tube bore holes for ſmall rockets thereon, after which you burn, with a red hot wire or ſmall iron, touch-holes, out of the large tubes, into the little ones, then fill the globe with the following compoſition, *viz.*

Two pound of ſaltpetre, eight ounces of brimſtone, eight ounces of meal-powder, twelve ounces of ſaw-duſt this done cloſe the top with a ſtopple, which has a touch-hole in the middle, then put a good deal of meal powder in the ſmall tubes, up to the touch-holes; and after you have plac'd your rockets upon that, fill the vacancy round with a little corn-powder, glew over them paper caps, then dip the globe into pitch, but not over the paper covering; fix a counterpoiſe at bottom; and when the fire has burn'd half way or further, in the large tube, it will communicate through the touch-holes, and diſcharge all the rockets at once.

The ſecond ſort is done after the ſame manner, only the middle tube is not bored ſo wide, becauſe of giving more room for two rows of ſmall tubes round it; the firſt row next to the tube is bored a little below the middle, the ſecond almoſt near to the end thereof; the touch-holes for the former are burnt from the inſide of the great tube, and thoſe of the latter from the outſide hole are cloſed again with a wooden pin: in the large tube you may lodge a ſtrong report of iron, charg'd with corn-powder, having a touch-hole left at top. See Fig. 59, 60.

Charges for ſingle Water-globes.

CORN-powder half a pound, ſaltpetre ſixteen pound, brimſtone four pound, ivory ſhavings four ounces, ſaw-duſt boil'd in ſaltpetre lee four pound.

Meal-powder one pound, ſaltpetre ſix pound, brimſtone three pound, iron filings two pound, and roſin half a pound.

Meal-powder four pound, ſaltpetre twenty-four pounds, brimſtone twelve pound, ſaw duſt eight pound, powdered glaſs, half a pound, and camphir half a pound.

Corn-powder one ounce, ſaltpetre twelve ounces, brimſtone four ounces, and ſaw-duſt three ounces.

Saltpetre twelve ounces, brimſtone four ounces, ſaw-duſt two ounces, melted ſtuff three quarters; this muſt be ram'd in tight.

Meal-powder one pound four ounces, ſaltpetre one pound eight ounces, brimſtone nine ounces, ſaw-duſt five ounces, pounded glaſs one ounce, melted ſtuff four ounces; mix them together with a little linſeed oil.

Meal powder eight ounces, ſaltpetre five pound, brimſtone two pound, copper filings eight ounces and a half, and coarſe coal duſt eight ounces and a half.

Saltpetre eight ounces, brimſtone three ounces, ſaw-duſt one ounce, and tanners-bark two ounces.

Saltpetre ſix pound twelve ounces, brimſtone two pound fourteen ounces, melted ſtuff half a pound, ſaw-duſt one pound, coarſe coal-duſt one pound, and pounded glaſs one pound, mix'd up and moiſten'd with vinegar.

Saltpetre two pound twelve ounces, brimſtone two pound ſix ounces, melted ſtuff four ounces, ſaw-duſt eight ounces, charcoal one ounce and a half, and pounded glaſs three quarters of an ounce, moiſten'd with linſeed oil, and mix'd up with a little corn-powder.

Charges for double Water-globes.

SAltpetre four pound ſix ounces, brimſtone one pound four ounces, ſaw-duſt half a pound, and coarſe-coal duſt ſix ounces, moiſtened with a little vinegar or linſeed oil.

Meal-powder one pound four ounces, brimſtone four ounces, and charcoal two ounces, moiſtened with *Petrolium* oil.

Saltpetre three pound, brimſtone a quarter of a pound, and ſaw-duſt boiled in ſaltpetre ten ounces, moiſtened a little.

Charges

Charges for Bee-ſwarms.

MEAL-powder thirteen ounces and a half, ſaltpetre ſix ounces, brimſtone two ounces and a half, fine charcoal three ounces, coarſe charcoal one ounce, and fine ſaw-duſt three ounces.

Meal-powder three quarters of a pound, ſaltpetre ſix ounces, brimſtone three ounces and a half, fine charcoal four ounces, and coarſe charcoal two ounces and a half.

Meal-powder four parts, ſaltpetre eight parts, brimſtone two parts, coarſe charcoal two parts, and fine charcoal one part.

Odoriferous, or perfumed Water-balls.

HAVE balls turned about the ſize of large walnuts, fill them with any of the compoſitions ſpecified below; after they are filled and ready, light and put them into water. This is generally done in a large room or hall, at grand entertainments.

The Compoſitions for them are as follows:

SAltpetre four ounces, *Storax Calamita*, one ounce, frankincenſe one ounce, maſtic one ounce, amber half an ounce, civet half an ounce, ſaw-duſt of juniper two ounces, ſaw-duſt of cypreſs two ounces, and oil of ſpike one ounce.

Saltpetre two ounces, flower of ſulphur one ounce, camphir half an ounce, raſpings of yellow amber half an ounce, coal of lime-tree wood one ounce, flower of benjamin, or *Aſſa odorata* half an ounce; let thoſe which are to be powdered, be done very fine; then mix them together as uſual.

Saltpetre two ounces, myrrh four ounces, frankincenſe three ounces, amber three ounces, maſtic one ounce, camphir half an ounce, roſin one ounce, boiled ſaw-duſt one ounce, lime-tree coals half an ounce, bees-wax half an ounce; mix them up with a little oil of juniper.

Saltpetre one ounce, myrrh four ounces, frankincenſe two ounces and a half, amber two ounces, mother of pearl four ounces, melted ſtuff half an ounce, and roſin half an ounce; mix them up with oil of roſes.

Meal-powder three ounces, ſaltpetre twelve ounces, frankincenſe one ounce, myrrh half an ounce, and charcoal three ounces, mix'd with oil of ſpike.

The Manner of preparing the Melted Stuff.

MELT twenty four pound of ſulphur in a ſhallow earthen pan, over a clear fire, and as it melts fling in ſixteen pound of ſaltpetre; ſtir them well together with an iron ſpatula; as ſoon as they are melted take it off the fire, and add to it eight pound of corn-powder; mix it well together, and being cooled, pour out this compoſition upon a poliſhed marble, or metal-plates, and then divide it into pieces about the ſize of a walnut. This compoſition is chiefly uſed in military fire-works, and not for thoſe I am treating of; but for thoſe fire-works which are only for pleaſure: it is diſtinguiſh'd by warm and cold melted ſtuff, and is prepared in the following manner.

Take for the firſt ſort half a pound of ſaltpetre, grind among it three quarters of an ounce of antimony, till one cannot be diſtinguiſhed from the other: then melt one pound and a half of brimſtone, put the mix'd ſaltpetre and antimony to it, and mix them well together; this done put it warm into a wooden mould of two pieces, which ſhould be well greaſed on the inſide: this ſtuff you break afterwards in bigger or leſſer pieces; it is, on account of its clear fire, uſed to imitate ſtars.

The Manner of preparing the cold melted ſtuff.

GRIND the above ingredients, or eight ounces of meal-powder, four ounces of ſaltpetre, three ounces of brimſtone, and one ounce of coal-duſt, together, till all is of one colour; this done, moiſten that ſtuff with the white of eggs, gum-water, or ſize, and make thereof a ſtiff dough; then ſtrew on a ſmooth board ſome meal-powder, roll the dough upon that a quarter of an inch thick, ſtrew again meal-powder upon it, then cut it in ſquare pieces, and let them dry; or elſe form ſmall balls of it, of the ſize of a ſmall nut or larger; then roll them in meal-powder and put them up to dry.

To prepare a Globe which burns like a Star, and leaps about both on Land and Water.

CAUSE a globe to be turned of dry wood, whoſe diameter is the length of a half pound or a pound rocket: divide this globe into two equal parts, in the middle of one of the half globes, on the inſide, make a cavity, deep, long, and wide enough to hold three or four rockets or crackers, ſo that the other half of the globe may be eaſily and cloſely fitted upon them; after this take three crackers, one with ſtrong reports and two without any, place them ſo into the hollow, that the head of the one may lay to the other's neck, and be ſo ordered that as ſoon as the one is ſpent, the other may take fire and force the globe back, and thus alternately from one to the other till it comes to the report, which finiſhes. Care muſt be taken that the fire paſſes not from the firſt to the next cracker, before it has quite conſumed the firſt; but as I have given a caution in the article about rockets that run on a cord, the ſame may be obſerved here.

Having taken care to fix the rockets, cover them with the other half globe, and join them firmly with ſtrong paſted paper.

To charge Globes, which leap on Land, with Iron and Paper Crackers.

TAKE a hollow wooden globe, which has a touch-hole at the top, in the form of a ſmall cylinder; fill it with an aquatic compoſition quite full; then bore into the charge five or ſix holes about half an inch wide, in which put iron petards or crackers, which run tapering; provide them at the lower end with a ſmall touch-hole, and cover the top with a tin-plate, in which there is four holes, which you muſt cloſe up with wads of paper or tow, after you have filled them with the beſt corn-powder: and when you fire them on even ground, you will ſee them leap as often as a cracker goes off. See Fig. 61.

The other ſort is not much unlike the firſt, except that to this you add a certain number of crackers, which are diſpoſed as you may obſerve in Fig. 62. A the crackers, B the touch-hole.

How the Globes, diſcharg'd out of a Mortar, are made and ordered.

FIRST find the mouth of the mortar, and divide it in twelve parts; then have a globe turn'd of wood, which is two diameters of the mouth high; divide the diameter in ſix equal parts, and let the height between A and C be the diameter of the globe, the radius of the ſemi-circle C I, ſhall be one ſixth, or half the height of the globe, the thickneſs of the wood H I, ſhall be $\frac{1}{12}$ of the above diameter, and the thickneſs of the cover of the diameter of the globe; the diameter of the cavity of the globe five ſixths of its whole diameter; the height of the priming chamber B F ſhall be one ſixth and a half of the diameter, but its breadth only one ſixth; the diameter of the touch-hole is one fourth or one ſixth of that of the chamber: for the better underſtanding theſe directions, ſee Fig. 63.

The manner of filling theſe globes is thus.

Take hollow canes or common reeds, cut them into lengths to fit the cavity of the globe, and fill them with a weak compoſition made of three parts meal-powder, two of coal, and one of brimſtone, moiſten'd with a little linſeed oil; excepting the lower ends of them, which reſt upon the bottom of the globe, which muſt have meal-powder only, moiſten'd likewiſe with the ſame oil; or ſprinkled over with brandy and dry'd: the bottom of the globe cover with meal-powder mix'd with an equal quantity of corn-powder; the reed being fill'd in this manner, ſet as many of them upright in the cavity of the globe, as it will contain; then cover it well at top; and wrap it up with a cloth dip'd in glue, the priming muſt be of the ſame compoſition with the reeds.

The globes repreſented; N° 97 and 98 are contrived like the above, only the firſt of theſe is fill'd with running rockets, and the laſt with crackers, ſtars, and ſparks, interſperſed with meal-powder; and put promiſcuouſly over the crackers; the figures are ſo plain, that I need not give any further explanation.

N° 99 is the repreſentation of a globe, which plainly ſhews its conſtruction: the great globe which contains the leſſer is the ſame as deſcribed above; for it is charged with running rockets; as that of 97. However with this difference, that this is lined but with ſingle rockets, and the other is fill'd up with them. In the midſt of theſe rockets fix a globe in a cylindrycal form, with a flat bottom, and a chamber and touch-hole at A, the cavity of this inner globe is fill'd with iron crackers, and cover'd with a flat covering: the priming chamber fill with the ſame compoſition as has been directed for the above globes; the fuzees muſt be fill'd with good meal-powder.

N° 100 ſhews another ſort of globe, which is prepared thus. Firſt get a wooden globe, in the middle whereof fix a mortar with a little chamber for powder, round which form a lodge, for ranging paper tubes, this lodge muſt have a groove or channel, fill'd with meal-powder, to convey the fire all round; this done, put a globe into the mortar, fill'd with running rockets, crackers, reeds, or ſtars and ſparks; and having placed your paper tubes fill'd with running rockets round the groove, cover them about with ſtrong paſted paper and cloth, dipp'd in glue, as has been directed. The figure of this globe will illuſtrate the deſcription, A ſhews the mortar, B the touch-hole, C the priming chamber, D the priming of the mortar, E in the other figure repreſents the order in which the paper tubes are placed upon the groove.

To form Letters, and all Sorts of Figures which may be repreſented in the open Air in a dark Night.

PROVIDE a wooden globe of the ſame form, height, breadth and thickneſs, as thoſe already deſcrib'd, only the priming chamber muſt be the height and breadth of one ſixth of the diameter of the whole globe. Beſides this chamber there muſt be another B, for corn-powder, the height and breadth muſt be equal to $\frac{1}{16}$ of the diameter of the globe, the vent-hole muſt be a quarter of the powder or priming-chamber; you muſt alſo have another globe in a cylindrical form, the bottom of which muſt be rounded on the outſide, as may be obſerved in the ſame figure by F, the cover muſt be let a little into the inner ſurface of the cover of the great globe, to keep it firm, placing this leſſer globe perpendicularly over the chamber, which is fill'd with corn-powdor.

Fill the cavity of the little globe with running rockets ſtars and ſparks, as may be ſeen in the figure at the bottom of the large globe; having furniſhed the vent-hole with meal and the chamber with corn powder, put about the ſmall globe the ſame compoſition, mix'd promiſcuouſly together, and on this fit a flat wooden ring, very tight to the globe, in which bore holes, as you ſee in Fig. 101. Your globe being thus prepared, take two long thin ſlips of whale-bone, which bend eaſily without breaking; join them together parallel, ſo as to have their bendings oppoſite to each other, and make a ſtraight piece; take two of theſe long pieces and join them as is ſeen in A by two ſhorter pieces at both ends, ſo as to make a right angled paralelogram, R S T U; within this frame form your letters, either of wire or whale-bone, placing each about a hands breadth from the other; and having fix'd your letters, wrap them neatly round in quick tow from one end to the other, taking care that none of it entangle about the frame, leaſt when the letters burn, their flame ſhould be confounded in one another; then ſteep your letters in brandy, wherein before you have diſſolv'd ſome gum-arabick, and in drying, ſtrew them over with meal-powder; if you would have your letters deſcend prependicular to the horizon, you muſt faſten two ſmall weights to your frame, at T and U, but if parallel to the plane of the horizon, you muſt have a weight at each corner; having order'd it thus, bend it round to go in the inner circumference of the great globe, and let it reſt perpendicular on the wooden ring, and fill the empty places about the letters with meal-powder; then cover it up, and prepare the globe fit for the mortar, as uſual; it will have a delightful effect.

To prepare the Quick Tow.

TAKE either flax, hemp, or cotton, of two or three ſtrands, twiſt them ſlightly and put them into a clean glaz'd earthen pan, pour on them good white-wine-vinegar four parts, urine two parts, brandy one part, purified ſaltpetre one part, meal-powder one part, boil it all together over a quick fire, till all the moiſture is evaporated; then ſtrew meal-powder on an even board, and roll your match therein, then let it dry either in the ſun or ſhade. This ſort of match burns and conſumes very quick, but if you would have it burn ſlower, make the liquor weaker, boiling the match in ſaltpetre and vinegar only, and ſtrewing meal-powder in it, let it dry.

Another ſort of match is made by ſome which is not twiſted at all, but only dip'd in brandy for ſome hours, then powdered over with meal-powder and dry'd; ſome diſſolve a little gum-arabic or tragacant in the brandy, this will make it ſtick the better to any thing.

To prepare the light Balls, proper to be uſed at Bonfires.

TAKE two pound of crude-antimony, four pound of brimſtone, four pound of roſin and four pound of coal, and half a pound of pitch; having powdered all theſe ingredients, put them into a kettle or glaz'd earthen pan, over a coal fire, and let it melt; then throw as much hemp, or flax, into it as may be ſufficient to ſoak it up; then take it off the fire, and whilſt it is cooling, form it into balls.

You may wrap them up in tow, and put them either into rockets or globes.

To prepare the Paſte for Stars and Sparks.

TAKE five ounces and a half of meal-powder, one pound twelve ounces of brimſtone. *Or,*

Take three pound of meal-powder, ſix pound of ſaltpetre, one pound of brimſtone, two pound of camphir, and two ounces of tanner's bark or ſaw-duſt. Moiſten all theſe ingredients with linſeed oil.

Take meal-powder one pound, ſaltpetre four pound, brimſtone half a pound, and powder'd glaſs ſix ounces; moiſtened with a little linſeed oil.

Saltpetre half a pound, brimſtone two ounces, antimony one ounce, and meal-powder three ounces.

Saltpetre half a pound, brimſtone three ounces, antimony one ounce, and iron file-duſt half an ounce.

Saltpetre two pound, meal powder ten pound, and brimſtone one pound.

Saltpetre one pound, brimſtone half a pound, meal-powder three ounces, and antimony one ounce.

Having mixed and prepared your ingredients, boil ſome flax in ſaltpetre lee and camphir, then cut it ſmall and mix it up with any of the above compoſitions which muſt be moiſtened with either the white of eggs, gum, or ſize: form this into little balls of the ſize of a hazel-nut, ſtrew them over with meal-powder and let them dry.

To cauſe the ſtars to burn very bright, make your compoſition of one ounce and three quarters of ſaltpetre, three quarters of an ounce of brimſtone, and a quarter of an ounce of powder.

Saltpetre two pound, brimſtone fourteen pound and a half, and meal-powder ſix ounces.

The paſte or melted ſtuff above mentioned, is alſo made uſe of for the ſame purpoſe, wrapt in tow.

To project Globes from a Mortar, and the Quantity of Powder required for that Purpoſe.

THE globes being of wood, it is requiſite that the charges for them ſhould be agreeable to their ſubſtance, for which end they are firſt weighed, allowing for each pound of its weight a quarter of an ounce of gun-powder. For example, if your globe weighs forty pound, you muſt, to diſcharge it, allow ten ounces of powder.

The charge is thus performed; put the powder into the chamber of the mortar, and cover it with ſtraw, hay, hemp, or flax, ſo as to fill it quite full; or if the chamber of the mortar be too big, get one turned of wood equal in height and breadth to the chamber of the mortar, that contains the charge of powder required; pierce this with a red hot wire, from the bottom of the wood to the centre of the bottom of the chamber in it, not perpendicular but ſlanting, as from *c* to *b* in Fig. A. The place, where the touch-hole begins, muſt be mark'd, ſo that you may turn it to correſpond with the touch hole of the mortar. When you would load your mortar, cover the bottom of the chamber with a little meal- and corn-powder, mix'd together, and upon that put the wooden chamber, in which is the powder requir'd to diſcharge the globe; then fix the touch hole of the globe exactly upon the chamber, wrapping it in hemp, &c. to make it ſtand upright.

The mortars contrived on purpoſe for globes are more commodious, and one is more certain in projecting them; theſe are caſt as follows: the length of the mortar with the chamber, without the bottom, is two diameters of the mouth; the bottom is one fifth thick; the chamber is half the diameter of the mouth long, and a quarter wide, oval at bottom; the ſides are an eighth of the diameter of the mouth thick, which is increaſed at bottom to a third; the thickneſs about the chamber is a fouth part.

Some prepare theſe balls with ſaltpetre four pound, brimſtone one pound and a half, powder half a pound, antimony ſix ounces, and charcoal half an ounce.

Saltpetre four pound, brimſtone three pound, camphir a quarter of a pound, and powder half a pound.

PART XIV.

The Art of dying SILKS, WORSTEDS, COTTONS, *&c.* of various Colours.

THE art of dying in colours, is of great antiquity, as appears both from ſacred and profane hiſtory; but who were the firſt inventers thereof, is uncertain; however, for the generality it is conjectured that like many others it had it firſt birth by accident: the juices of certain fruits, leaves, *&c.* accidentally cruſhed, are ſuppoſed to have given the firſt hint. Purple, an animal juice, found in a muſſel, was firſt diſcovered to be of a tinging quality, by a dog's catching one of the purple-fiſhes among the rocks, which in eating ſtained his mouth with that precious colour: this colour was in ſo high eſteem among the *Romans*, that none but their emperors were ſuffered to wear it. I could give the curious a long hiſtorical and ſpeculative account concerning this ingenious art, but being a ſubject not ſuitable to the intent of this work, I ſhall only inform my readers in the practice thereof, in as conciſe and plain a manner as poſſible. My firſt leſſon is:

How to dye Silk or Worſted of a fine Carnation Colour.

FIRST take to each pound of ſilk, four handfuls of wheaten bran, put it in two pails of water, boil it, pour it into a tub, and let it ſtand all night; then take half the quantity of that water, put into it ½ a pound of allum, ¼ of a pound of red tartar, beaten to a fine powder, and ½ an ounce of fine powdered curcumi; boil them together, and ſtir them well about with a ſtick; after they have boiled for a quarter of an hour, take the kettle off the fire, put in the ſilk, and cover the kettle cloſe to prevent the ſteam from flying out; leave it thus for three hours, then rince your ſilk in cold water, beat and wring it on a wooden pin, and hang it up to dry.

Then take $\frac{1}{4}$ of a pound of gallnuts, beat them fine, and put the powder thereof into a pail of river-water; boil it, for one hour; then take off the kettle, and when you can bear your hand therein, put in your ſilk, and let it lay therein an hour, then take it out and hang it up to dry. When the ſilk is dry, and you would dye it of a crimſon colour, weigh to each pound of ſilk $\frac{3}{4}$ of an ounce of cochineel, which beat to a fine powder, and ſift it through a fine hair ſieve; then put it in the pail with the remaining lee, and having mix'd it well, pour it into a kettle, and when it boils, cover it well to prevent any duſt coming to it; after you have put in $\frac{3}{4}$ of a pound, and two ounces and a half of tartar, both finely powdered, let it boil for a $\frac{1}{4}$ of an hour; then take it off the fire, let it cool a little and put in the ſilk, ſtir it well with a ſtick to prevent its being clouded, and when cold wring it out. If the colour is not deep enough, hang the kettle again over the fire, and when it has boiled and is grown lukewarm again, repeat the ſtirring of the ſilk therein; then hang it upon a wooden pin which is faſtened in a poſt, wring and beat it with a ſtick; after this, rience the dy'd ſilk in hot lee, wherein to one pound of ſilk, you have diſſolved $\frac{1}{2}$ an ounce of *Newcaſtle* ſoap, afterwards rince it in cold water. Hang the skeins of raw-ſilk on a wooden pin, putting a little hand-ſtick to the bottom part, and thus having worked, wrung, and beat it round, you muſt hang it up to dry.

Another Method to dye Silk of a crimſon Red.

TAKE of good *Roman* allum $\frac{1}{2}$ an ounce, tartar one ounce, ſpirit of vitriol $\frac{1}{4}$ of an ounce, and put them pulverized into a pewter kettle, and pour as much water on them, as is ſufficient for the quantity of $\frac{1}{2}$ an ounce of the ſilk you purpoſe to dye; when it is ready to boil, put in the ſilk, which before you muſt boil in bran; boil it for an hour or more, then wring it out, and put to the liquor $\frac{1}{2}$ an ounce of cochineel finely powdered, and 60 drops of ſpirit of vitriol;

when ready to boil, put in the ſilk again, and let it ſoak for four hours; then take clean water, drop into it a little ſpirit of vitriol, rince therein the ſilk, take it out again, and dry it on ſticks in the ſhade. This will be a high colour, but if you would have it of a deep crimſon, you take inſtead of ſpirit of vitriol, ſpirit of ſal-armoniac, to rince your ſilk in.

General Obſervations in dying Crimſon, Scarlet, or Purple.

1. YOUR copper or kettle muſt be of good pewter quite clean and free from any ſoil or greaſe.

2. The prepared tartar muſt be put in when the water is luke-warm.

3. If you intend to dye woollen or worſted yarn, you may put it in the firſt boiling, and let it boil for two hours.

4. When boil'd take it out, rince it, clean the kettle, and put in the water for the ſecond boiling.

5. This ſecond boiling is performed in the ſame manner as the firſt; then put in cochineel finely powdered, when it boils hard, ſtir it well about.

6 Then the ſilk, which before has been waſhed and cleanſed in the firſt lee, is put in on a winch, which is continually turned about, in order to prevent the colours from fixing in clouds.

7. When the colour is to your mind, take it out of the copper, rince it clean, and hang it up in a room or a ſhady place, where it may be free from duſt.

8. You muſt obſerve, that when the aqua-fortis, is put into the ſecond boiling, it cauſes a coarſe froth to ſwim at top: which you muſt carefully take off.

How to diſſolve the Pewter for Dyer's Aqua-Fortis.

TAKE fine pewter, pour firſt a little clear water over it, then pour on the aqua-fortis, which will diſſolve it. The ſolution is of a whey of milk colour, temper it by adding more aqua-fortis, till it is clear. The common proportion is, to one ounce of aqua-fortis add a quarter of an ounce of pewter.

To dye a Crimſon with Orchal.

PUT clean water into the copper, and to each pound of ſilk take 12 ounces of orchal; in this turn your ſilk and wring it out; then diſſolve to each pound of ſilk ¼ of a pound of allum, and as much of white arſenic; in this liquor put the ſilk all night to ſoak; then wring it out; this done, take to each pound of ſilk, two ounces of cochineel, two ounces of galls, two ounces of gum, with a little curcuma: in this boil the ſilk for two hours; then put in a little zepſie, let it ſoak all night, and in the morning rince it out.

To dye a Violet Colour.

FIRST boil your ſilk in bran and allum, as has been ſhewn above; then clean your copper, and with clean water, put to each pound of ſilk, one ounce of galls, one ounce and a half of cochineel finely powdered, and one ounce of gum arabick, boil it together like the crimſon red; leave it all night, and the next morning take out your ſilk, and rince it in fair water.

To dye Worſted, Stuff, or Yarn of a Crimſon Colour.

TAKE to each pound of worſted, two ounces of allum, two ounces of white tartar, two ounces of aqua-fortis, ½ an ounce of pewter, ¼ of a pound of madder, and ¼ of a pound of logwood, put them together in fair water, boiling the worſted therein for a conſiderable time; then take it out of the copper, and when cool, rince it in clean water: then boil it again, and put to each pound of worſted, ¼ of a pound of logwood.

Another

Another Method.

TAKE to eight pound of worſted, ſix gallons of water, and eight handfuls of wheaten bran; let them ſtand all night to ſettle, in the morning pour it clear off, and filtrate it; take thereof half the quantity, adding as much clear water to it; boil it up, and put into it one pound of allum, and half a pound of tartar; then put in the worſted, and let it boil for two hours, ſtirring it up and down all the while it is boiling with a ſtick. Then boil the other half part of your bran-water, mixing it with the ſame quantity of fair water as before; when it boils, put into it four ounces of cochineel, two ounces of fine powder'd tartar; ſtir it well about, and when it has boiled for a little while, put in your ſtuffs: keep ſtirring it from one end of the copper to the other with a ſtick, or turn it on a winch, till you ſee the colour is to your mind; then take it out of the copper, let it cool, and rince it in fair water.

Another for Silk.

TAKE to each pound of ſilk, a quarter of a pound of fernambuca, boil it up, and ſtrain it through a ſieve ino a tub, and pour water to it, till it is juſt luke-warm: in this turn your ſilk, which before has been prepared as has been directed, and when all the ſtrength is drawn out, rince, wring and dry it.

Another fine Carnation.

TAKE to each pound of ſilk, after it is rinc'd and dry'd four pound of ſafflower, put the ſafflower in a bag, and waſh it in clean water, till the water comes clear from it; then take the ſafflower out of the bag, preſs it between your hands, and rub it aſunder in a clean tub; take to each pound of ſilk, four ounces of pot-aſhes, work it well together with the ſafflower, divide it into two parts, pour one part thereof into a cloſe ſack, that will keep the pot-aſhes from coming out, otherwiſe it will make the ſilk ſpeckled, and pour clear water over, to draw the ſtrength out of the ſafflower; then take to each pound of ſilk, a quarter of a pint of lemon juice; divide that alſo into two parts, and put each to the two quantities of ſafflower: hang your ſilk well dryed on clean ſticks: and dip it in the firſt part of the liquor continually for an hour; then wring it well out, and hang it again on ſticks: having prepared the other part of the ſafflower as you did the firſt, dip it therein as before for the ſpace of an hour; then wring it well and hang it up to dry in the ſhade, and you will have a fine colour.

A Carnation for Woollen.

TAKE four ounces of ceruſe, three ounces and a half of arſenic, one pound of burned tartar, one pound of allum: boil your ſtuffs with thoſe ingredients for two hours; then take it out, and hang it up; the next morning make a dye of two pound of good madder, a quarter of a pound of orlean, two ounces of curcumi, and three ounces of aqua-fortis.

To dye a Carnation on Silk, or Cotton, with Fernambuca.

TAKE three pound of allum, three ounces of arſenic, four ounces of ceruſe; boil your ſilk or cotton therein for an hour; then take it out and rince it in fair water; after which make a lee of eight pound of madder, and two ounces of ſalt-armoniac, ſoak the ſilk or cotton therein all night, then boil it a little in fair water, and put into it one ounce of pot-aſhes; then pour in ſome of the lee, and every time you pour, the colour will grow the deeper, ſo that you may bring it to what degree or ſhade you pleaſe.

Another Method.

TAKE to one pound of ſilk, cotton, or yarn, one ounce of tartar, and half an ounce of white ſtarch; boil them together in fair water; then put in one quarter of an ounce of cochineel, a quarter of an ounce of ſtarch, and a quarter of an ounce of pewter, diſſolved in half an ounce of aqua-fortis, and mixed with fair water; when the water with the ſtarch and tartar has boiled for ſome time, ſupply it with the cochineel and the above aqua-fortis; put in your ſilk or whatever you have a mind to dye, and you will have it of a fine colour.

Another Method.

TAKE one ounce of tartar, ſtarch and lemon juice of each half an ounce, and cream of tartar a quarter of an ounce; boil them together in fair water, adding a quarter of an ounce of curcumi; put in half an ounce of cochineel, and a little while aftar one ounce of aqua-fortis, in which you have diſſolved a quarter of an ounce of pewter, and then put in your ſilk.

To dye Yarn or Linnen of a laſting Violet Colour.

TAKE one pound of tartar, half a pound of allum, two ounces of fernambuca, and half an ounce of ſaltpetre; boil them together, then let them cool a little, and put in your yarn; let it ſoak for four hours, keeping the dye hot but not boiling, after which rince and dry it.

How to prepare or ſet a blue Vat for dying.

HEAT ſoft water in a kettle or copper, fling four or five handfuls of wheaten bran, together with four pound of pot-aſhes into it, when that is diſſolved boil it for an hour, and then add four pound of madder; with this boil it for an hour longer, then pour the water into the vat, fill it not full by the height of a foot, and then cover your vat; then ſet it with indigo and woad, of each ſix pound, and two pound of pot-aſhes; put this into a ſmall kettle in warm water, ſet it on a ſlow fire, and let it boil gently for half an hour ſtirring it all the while; then pour that to the other liquors already in the vat.

To ſet a vat with indigo only, you muſt boil the firſt lee with pot aſhes, four or five handfuls of bran, and half or three quarters of a pound of madder; this you boil a quarter of an hour, and when ſettled it will be fit for uſe. Then grind your indigo in a copper bowl, with an iron ſmooth ball very fine, pouring on ſome of the lee, and mixing it together; when ſettled, pour the clear into the blue vat, and on the ſediment of the indigo, pour again ſome of the lee, this you ſhould repeat till you ſee the blue tincture is extracted clearly from it.

It is to be obſerved, that the madder muſt be but ſparingly uſed, for it only alters the colour, and makes it of a violet blue, which, if you deſign to have, cochineel is the fitter for. The mix'd colours in blue are the following: dark blue, deep blue, high blue, sky blue, pale blue, dead blue, and whitiſh blue.

By mixing of blue and crimſon, is produced purple, columbine, amaranth, and violet colours; alſo from thoſe mixtures may be drawn the pearl, ſilver, gridelin, *&c.* colours.

From a middling blue and crimſon are produced the following colours, *viz.* the panſy, brown grey, and deep brown.

Care muſt be taken that in ſetting the blue vat, you do not overboil the lee, by which the colour becomes muddy and changeable; be alſo ſparing with the pot-aſhes, for too much thereof gives the blue a greeniſh and falſe hue; but experience is the beſt inſtructer in this.

Another Direction how to ſet a Blue Vat; together with ſeveral Obſervations in the Management thereof, both for Silk or Worſted.

TAKE half a buſhel of clean beech aſhes, well ſifted, of this make a lee with three pails of river or rain-water, pour it into a tub, and put in two handfuls of wheaten bran, two ounces of madder, two ounces of white tartar finely powdered, one pound of pot-aſhes, half a pound of indigo pounded; ſtir it all well together, once every 12 hours for 14 days ſucceſſively, till the liquid appears green on your fingers, and it is fit to dye, however when ready, ſtir it every morning, and, when you have done, cover it.

When you are going to dye ſilk, firſt waſh the ſilk, in a freſh warm lee, wring it out and dip it into the vat; you may dye it what ſhade you pleaſe, by holding it longer or ſhorter in the dye.

When the colour is to your mind, wring the ſilk, and having another tub, ready at hand with a clear lee, rince therein your ſilk, then waſh and beat it in fair water, and hang it up to dry.

When the vat is waſted, fill it with the lee, but if it grows too weak ſupply it with half a pound of pot-aſhes, half a pound of madder, one handful of wheat-bran, and half an handful of white tartar; let it ſtand for eight days, ſtirring it every 12 hours, and it will be again fit for uſe.

Another Method for Woollen.

FILL a kettle or copper with water; boil it up, and put pot-aſhes into it; after it has boil'd with that a little, put in two or three handfuls of bran, let it boil for $\frac{1}{4}$ of an hour, then cover it; take it off the fire and let it ſettle.

Pound the indigo as fine as flower: then pour off the above lee to it, ſtir it and let it ſettle, and pour the clear lee into the vat; then pour more lee to the ſediment, ſtir it, and when ſettled, pour that into the vat alſo; repeat this till the indigo is waſted. *Or,*

Take to $\frac{1}{4}$ of a pound of indigo, $\frac{1}{2}$ a pound of pot-aſhes, $\frac{1}{4}$ of a pound of madder, three handfuls of borax, let it boil for $\frac{1}{2}$ an hour, and then ſettle; with this lee grind your indigo in a copper bowl; put this on an old vat of indigo, or on a new one of woad, and it will make it fit for uſe in 24 hours.

To dye Silk of a Straw Yellow.

TAKE allum and rinſe your ſilk well, as has been directed before, then take and boil to each pound of ſilk, one pound of fuſtic or rocaw, and let them ſtand for $\frac{1}{4}$ of an hour; then put into a tub, large enough for the quantity of the ſilk, a ſufficient quantity of that lee and fair water; in this rince the ſilk; fill the kettle again with water, and let it boil for an hour, and having wrung the ſilk out of the firſt liquor and hung it on ſticks, prepare a ſtronger lee than the firſt, in this you dip your ſilk ſo long till the colour is to your mind.

Another Method.

PUT into a clean copper or kettle to each pound of ſilk, two pound of fuſtick, let it boil for an hour, then put in ſix ounces of gall, let it boil together $\frac{1}{2}$ an hour longer; the ſilk being allum'd and rinc'd, is turn'd about in this colour, then take it out of the kettle, and wring it out; dip it in pot-aſh-lee, and wring it out again; then put it into the copper, let it ſoak a whole night, and in the morning rince, beat it out, and hang it up to dry.

Of dying Silk, &c. of different Greens.

THE middling colour of bue and yellow produces a light green, graſs green, laurel green, ſea-green, *&c.*

All olive-colours, from the deepeſt to the lighteſt are nothing elſe but green colours, which by walnut-tree root, fuſtic or ſoot of the chimneys, are chang'd to what ſhade you pleaſe.

A fine Green for dying Silk.

TAKE to one pound of ſilk ¼ of a pound of allum, two ounces of white tartar, put them together in hot water to diſſolve, and when ſo, put in your ſilk and let it ſoak all night, take it out the next morning, and hang it up to dry; then take one pound of fuſtic, boil it in four gallons of water, for an hour long; take out the fuſtic, fling it away, and put into the copper ½ an ounce of fine beaten verdigreaſe, ſtir it about for ¼ of an hour, draw it off into a tub, and let it cool, then put into that colour one ounce of pot-aſhes, ſtir it together with a ſtick, dip into it your ſilk, ſo long till you think it yellow enough, then rince it in fair water and hang it up to dry; then dip it in the blue vat, till you think it enough; rince it again and beat it over the pin, and hang it up to dry; thus you may change the ſhades of your green by dipping either more or leſs, in the blue or yellow.

For the green, take to one pound of ſilk three ounces of verdigreaſe, beaten to a fine powder, infuſe it in a pint of wine vinegar for a night, then put it before the fire, when hot ſtir it with a ſtick, and keep it from boiling; in this put your ſilk two or three hours, or if you would have it of a light colour, let it ſoak but for ½ of an hour, then take ſcalding hot water, and in a trough, rub'd over with *Newcaſtle* ſoap, beat and work it up to a clear lather, in this rince your ſilk, then hang it up to dry; rince it again in river-water, beat it well, and when it is well clean'd, and dry'd, dreſs it.

How to dye Linnen of a Green Colour.

SOAK your linnen over night, in ſtrong allum water, then take it out to dry; take woad, boil it for an hour long; take out the woad, and put in one ounce of powder'd verdigreaſe, or according to the quantity you have to dye, more or leſs; ſtir it, together with the linnen, briskly about; then put in a piece of pot-aſh, the bigneſs of an hen's egg, and you will have your linnen of a yellow colour, which when dry'd a little, being put into a blue vat, will turn green.

To dye Yarn of a Yellow Colour.

IN a copper of ſtrong lee put a bundle of woad, and let it boil, then pour off the lee, and take to one pound and a half of yarn, half an ounce of verdigreaſe, and half an ounce of allum, put it into a quart of brown braſil-wood liquor, boild with lee, ſtir it well together, and pour it in and mix it with the woad-lee; in this ſoak your yarn over night and it will be of a good yellow.

To dye Green Yarn or Linnen Black.

TAKE a ſharp lee, put in three pound of brown braſil, and let it boil for ſome time, then pour off the colour from the chips, into a tub, add to it one ounce of gum-arabick, one ounce of allum, one ounce of verdigreaſe; in this lay your yarn or linnen to ſoak over night, and it will be of a good black.

To dye Silk an Orange Colour.

AFTER you have clean'd your kettle well, fill it with clean rain-water, and take to each pound of ſilk four ounces of pot-aſhes, and four ounces of orlean, ſift it through a ſieve into the kettle; when it is well melted, and you have taken care not to let any of thoſe ingredients ſtick about the kettle, then put in your ſilk, which before you have prepared and allum'd as has been directed; turn it round on the winch and let it boil up, then take and wring it out, beat it and rince it; then prepare another kettle, and take to each pound of ſilk twelve ounces of gall-nuts, let the gall-nuts boil for two hours, then cool for the ſame ſpace of time; after which put in the ſilk for three or four hours, then wring it out, rince, beat and dry it.

Another Orange Colour.

SOAK the white ſilk in allum water like as you do in dying of yellow; then take two ounces of orleans-yellow, put it over night in water, together with one ounce of pot-aſhes: boil it up, add to it, after it has boil'd half an hour, one ounce of powdered curcumi, ſtir it with a ſtick, and after a little while put your allum'd ſilk into it for two or three hours, according to what height you would have your colour; then rince it out in clear ſoap-ſuds, till it looks clear, afterwards clear it in fair water, and dreſs it according to art.

A fine Brimſtone Yellow for Worſted.

TAKE three pound of allum, one pound of tartar, and three ounces of ſalt; boil the cloth with theſe materials for one hour; then pour off that water, and pour freſh into the kettle, make a lee of ſhart and pot-aſhes, let it boil well, and then turn the cloth twice or thrice quickly through upon the winch, and it will have a fine brimſtone colour.

A Lemon-Colour.

TAKE three pound of allum, three ounces of ceruſe, three ounces of arſenic, with theſe ingredients boil the cloth for an hour and a half; then pour off that water and make a lee of 16 pound of yellow flowers, three ounces of curcumi; then draw or winch your cloth through quickly, and you will have it of a fine lemon-colour.

To dye an Olive-Colour.

TO dye this colour obſerve the firſt directions for dying a brimſtone-colour; then make a lee of gall-nuts and vitriol, but not too ſtrong; draw your ſtuff quickly, thro', three or four times, according as you would have it, either deeper or lighter.

To dye a Gold-Colour.

HAVING firſt dy'd your ſilk, worſted, cotton or linnen of a yellow colour, take to each pound of the commodity, one ounce of fiſet-wood or yellow chips, and of pot-aſhes the quantity of a bean, boil this for half an hour, then put in your ſilk, and turn it ſo long, till the colour is to your liking.

The Dutch *Manner of dying Scarlet.*

BOIL the cloth in allum, tarter, ſalgemma, aqua-fortis, and pea-flowers, either in a pewter kettle or with aqua-fortis, in which pewter is diſſolv'd; then put into the ſame kettle, ſtarch, tartar and cochineel finely powdered, ſtirring or turning the cloth well about, and thus you may, by adding more or leſs cochineel, raiſe the colour to what height you pleaſe.

General Obſervations for dying Cloth of a Red or Scarlet Colour.

1. THE cloth muſt be well ſoak'd in a lee made of allum and tartar, this is commonly done with two parts of allum and one part of tartar.

2. For ſtrengthening the red colour, you prepare a water of bran or ſtarch; the bran water is thus prepared; take five or ſix quarts of wheaten bran, boil it over a ſlow fire in rain-water for a quarter of an hour, and then put it with ſome cold water into a ſmall veſſel, mixing it up with a handful of leaven, the ſowerer it's made, the better it is; this cauſes the watet to be ſoft, and the cloth to become mellow; it is commonly uſed in the firſt boiling, and mix'd with the allum-water.

3. *Agaric,* is an ingredient uſed in dying of reds, but few dyers can give any reaſon for its virtue, but as it is of a dry ſpungy nature, it may reaſonably be ſuppoſed, that it contracts the greaſineſs which might happen to be in the dye.

4. The uſe of arſenic is not a very neceſſary, but a very dangerous ingredient; aqua-fortis, or ſpirit of ſalt, will ſupply its place as well.

5. To give a true diſcription of ſcarlet, it is nothing elſe but a ſort of crimſon colour, the aqua-fortis is the chief ingredient for the chance thereof; this may be try'd in a wine glaſs, wherein a deep crimſon colour may, by adding drops of aqua-fortis to it, be changed into a ſcarlet, or to a perfect yellow.

6. Obſerve that you always take one part of tartar to two parts of allum; moſt dyers prefer the white before the red tartar, but however, in crimſon colours and others that turn upon the brown, the red tartar is choſe by many as preferable to the white.

To prepare the Cloth for dying of Scarlet.

FIRST take to one pound of cloth, one part of bran-water, and two parts of river-water; then put into it two ounces of allum and one ounce of tartar, when it boils and froths, ſcum it, and put in the cloth, turn it therein for an hour, then take it out and rince it.

To dye Cloth of a common Red.

TAKE to twenty yards of cloth, three pound of allum, one pound and a half of tartar, and one third of a pound of chalk; put them in a copper with water, and boil them; then take ſix pound of good madder, and a wine-glaſs full of vinegar; let it be warmed together, and put in the cloth, turn it round upon the winch, 'till you obſerve it red enough; then rince it out, and it will be of a fine red.

Another Method.

TAKE four pound of allum, two pound of tartar, four ounces of white lead, and half a buſhel of wheat bran; put theſe ingredients, together with the cloth, into a copper; let it boil for an hour and half, and leave it therein to ſoak all night; then rince it, and take for the dye, one pound of good madder, two ounces of orlean, one ounce and a half of curcumi, and two ounces of aqua-fortis; boil them, turn the cloth with a winch for three quarters of an hour, and it will be of a good red.

To dye Scarlet.

TAKE to two pound of goad, two ounces of tartar, and one ounce of ſal-armoniac; grind them fine, and boil them up in fair water; add to them two ounces of ſtarch, half an ounce of gum-cotta, and one ounce of cochineel; when theſe are boiling hot, put in an ounce and half of aqua-fortis, and let it boil; then take it out, and when cool rince it.

To dye Brown Colours.

BROWN colours are produced from the root, bark, and leaves of walnut-trees, as alſo of walnut-ſhells; china-root might alſo be uſed for brown colours; but it being of a diſagreeable ſcent, it ſhould only be uſed for hair colours in ſtuffs, for which, and the olive colours, it is of more uſe: The beſt browns are dy'd with woad and walnut-tree root.

A Nutmeg-Colour on Stuffs.

TAKE three pound of allum, half a pound of tartar, put this into a copper of water, and boil your ſtuff for an hour and a half; and take it out to cool. Then take one pound and a half of fiſet-wood or yellow flowers, three pound of madder, one pound of gall-nuts; put it together with the ſtuff, into a copper, boil and turn it with a winch, till it is red enough, and take it out to cool; then take two pound of vitriol, which before is diſſolv'd in warm water, put it in the copper, and turn the ſtuff till the colour is to your mind; then rince it out. *Or*,

Take half a buſhel of green walnut-ſhells, or elſe walnut-tree-root, infuſe it in a kettle, and when it begins to boil put in the ſtuff over a winch, turn it about three or four times, then take it out and let it cool; after it is cold, boil the liquor again, and put the ſtuff in, turn it for half an hour, and take it out and let it cool; then put in one pound of gall-nuts, three pound of madder, together with the ſtuffs into the kettle, let it boil for an hour; take it out and let it cool again; take one pound of vitriol, put it in, ſtir it well about, then put in again the ſtuffs over the winch, turn and boil it ſo long till you perceive your colour deep enough; then take it out and rince it.

How to make Flax ſoft and mellow.

MAKE a ſtrong lee of wood or pot-aſhes, and unſlack'd lime, in which ſoak your flax for 24 hours; then put it together with the lee into a copper, and let it boil, and it will be as ſoft as ſilk. After this rince it in clean water; wring out the water, and put the flax again into a ſtrong lee; repeat this thrice, then rince it out, dry it, and it will anſwer your purpoſe. Some prefer cow-dung, with which the flax is daubed all over, or ſoak it in a lee of cow-dung for 24 hours, then rince and dry it.

An excellent Water for taking out Spots in Cloth, Stuff, &c.

TAKE two pound of ſpring water, put in it a little potaſhes, about the quantity of a walnut, and a lemon cut in ſmall ſlices; mix this well together, and let it ſtand for 24 hours in the ſun, then ſtrain it through a cloth, and put the clear liquid up for uſe; this water takes out all ſpots, whether pitch, greaſe or oil, as well in hats, as cloath, ſtuffs, ſilk, cotton and linnen, immediately; but as ſoon as the ſpot is taken off, waſh the place with water, and when dry you will ſee nothing.

To dye Woollen Stuffs of a Black Colour.

FINE cloths and ſuch ſtuffs as will bear the price muſt be firſt dy'd of a deep blue in a freſh vat of pure indigo; after which you boil the ſtuffs in allum and tartar; then you dye it in madder, and at laſt with gall of *Aleppo*, vitriol and *Sumach Arab.* * dye it black; to prevent the colour ſoiling when the cloaths are made up, they muſt, before they are ſent to the dye-houſe, be well ſcowered in a ſcowering mill.

Middling ſtuffs, after they have been prepar'd by ſcowering and drawn through a blue vat, are dy'd black with gall-nut and vitriol.

For ordinary wool or woollen ſtuffs take walnut-tree branches and ſhells, a ſufficient quantity; with this boil your ſtuff to a brown colour, then draw it through the black dye made with the bark of elder, iron, or copper filings, and indian-wood.

To

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* Is a ſhrub that grows in *Spain*, *Portugal* and *France*, from which countries it is carried in abundance to moſt parts of *Europe*; that which is good muſt be dry and of a light green colour, that of a brown hue is ſpent and good for little. It is uſed by black dyers, cordwainers, *&c.* The leaves boil'd in lee, dye hair black

To dye Linnen of a Black Colour.

TAKE filings of iron, waſh them, and add to them the bark of an elder tree; boil them up together, and dip your linnen therein.

To dye Woollen of a good Black.

1. TAKE two pound of gall-nuts, two pound of the bark of elder-tree, one pound and a half of yallow chips, boil them for three hours; then put in your ſtuff, turn it well with the winch, and when you perceive it black enough take it out and cool it.

2. Take one ounce and a half of ſal-armoniac, with this boil your ſtuff gently for an hour long, turning it all the while with the winch; then take it out again and let it cool.

3. Take two pound and a half of vitriol, a quarter of a pound of *Sumach*; boil your ſtuff therein for an hour; then cool and rince it, and it will be of a good black.

Another Black Colour for Woollen.

FOR the firſt boiling take two pound of gall-nuts, half a pound of braſil-wood, two pound and a half of madder; boil your cloth with theſe ingredients for three hours, then take it out to cool; for the ſecond boiling take one ounce and a half of ſal-armoniac, and for the third two ounces and a half of vitriol, three quarters of a pound of braſil, and a quarter of a pound of tallow.

Another Black Colour for Pluſh.

PUT the following ingredients into a large veſſel, *viz.* eight pound of elder bark, eight pound of *Sumach*, twelve pound of oaken chips, nine pound of vitriol, two pound of wild marjarum, ſix pound of tile-duſt, ſome waſte of a grind-ſtone, ſix pound of walnut-leaves, half a pound of burnt tarter, two pound of ſalt, four pound of woad; on theſe pour boiling water till your veſſel is full; your pluſh after it is well boil'd and cleanſed muſt be well gall'd, and this you do by boiling it in one pound and a half of *Sumach*, eight ounces of madder, two ounces and a half of burnt ſaltpetre, half an ounce of ſal-armoniac, one ounce and a half of vitriol, half an ounce of burnt-tartar, then take it out, and let it dry without rinceing it.

Then you fill the copper with the above liquor, and boil and dye your pluſh in the manner as you do other ſtuffs, turning it round with the winch; when the colour is to your mind, take out the pluſh, let it cool and then rince and hang it up to dry.

To dye Silk of a good Black.

IN a copper containing ſix pails of water, put two pound of beaten gall-nuts, four pound of *Sumach*, a quarter of a pound of madder, half a pound of antimony finely powdered, four ox-galls, four ounces of gum-tragacant, firſt diſſolv'd in fair water, of fine beaten elder-bark two ounces, and one ounce and a half of iron file-duſt; put theſe ingredients into the above water, and let them boil for two hours, then fill it up with a pail full of barley-water, and let it boil for an hour longer, then put in your ſilk, and boil it for half an hour ſlowly; then take it out and rince it in a tub with clean water, and pour that again into the copper; the ſilk you rince quite clean in a running water, then hang it up, and when it is dry, put it in the copper again; boil it ſlowly for half an hour as before, then rince it in a tub, and again in rain water; when dry, take good lee, put into it two ounces of pot-aſhes, and when they are diſſolv'd, rince the ſilk therein quickly, then in running water, this done, hang it to dry and order it as you do other colour'd ſilks.

This colour will alſo dye all ſorts of manufactur'd woollen ſtuffs.

To give the black ſilk a fine gloſs, you muſt, before the laſt dipping, put in for each pound one ounce of iſinglaſs, firſt diſſolv'd in water.

Another manner for dying Silk.

IN a copper of three pails of water put two ounces of borax, half a pound of *Agaricum*, a quarter of a pound of litharge of ſilver, four ounces of madder, one quartern of brandy, four ounces of verdigreaſe; let them boil together for an hour, then cover the copper and let the liquid reſt for 14 days: when you deſign to uſe it, take two pound of *Sennes* leaves, two pound of *Gentian*, one pound of *Agarica*, two pound of granat ſhells; let them boil together for two hours, and then put it to the other liquor ſettled in the copper: this colour will keep good for many years, and the longer you dye therein, the better it will grow, you muſt be careful to keep it free from ſoap, which would ſpoil it ſo as not to be recover'd by any means; and in caſe by accident ſome tallow ſhould happen to drop from your candle into it, then forbear meddling with it till it is cold, when ſo, take it off carefully; or heat your poker red hot and ſweep it over the ſurface, this will take off all the greaſineſs: then take two or three little bags of canvas, fill'd with bran, hang them in the colour for two or three hours whilſt the copper is heating, then clap whited brown paper on the ſurface of the colour, which will take off all the greaſineſs that might remain, after that begin to dye.

Your ſilk that is to be dyed muſt be firſt boiled in bran, then gall'd; to each pound of ſilk take twelve ounces of gall-nuts; boil the gall-nuts for two hours, before you put the ſilk into it, which muſt ſoak therein for 30 hours.

To dye a Grey Colour.

GREY is a middle colour, between black and white, which beginning with a white grey, approaches by degrees to a black grey: it may be obſerved, that if the black colour was to be prepared only of gall-nuts and vitriol, it would procure but an indifferent grey, but if to theſe ordinary ingredients for dying of ſtuffs, you add ſome indian-wood, you may procure white grey, pearl colour, lead colour, whitiſh grey, iron grey, black grey, brown grey, &c. Some of theſe colours require a little tincture of the woad.

To dye a Brown-red Colour either on Silk or Worſted.

FIRST, after you have prepar'd your ſilk or worſted in the manner directed for dying of red colours, boil it in madder, then ſlacken the fire under the copper, and add to the madder liquor ſome black colour, prepared as has been ſhewn, then ſtir the fire, and when the dye is hot, work the commodities you have to dye therein, till you ſee them dark enough.

But the beſt way to dye this colour is in a blue vat, therefore chuſe one either lighter or darker, according as you would have your colour; then allum and rince your ſilk in fair water, this done, work it in the copper with madder, till you find it anſwer your purpoſe.

Another.

PUT into a kettle of hot water a handful of madder, ſtir it together, and let it ſtand a little; then take the woollen ſtuff, wet it firſt, then let it run over the winch into the kettle, turning it conſtanly; if you ſee it does not make the colour high enough, add a handful more of madder, rincing the ſtuff or ſilk ſometimes to ſee whether it is to your liking.

Then put ſome black colour into the kettle, mix it well together, ſtir the fire, and when hot, turn your ſilks or ſtuffs with the winch, and dye it either of a blacker hue by adding more black, or a redder by putting in leſs.

Of Madder and its Uſefulneſs in Dying of Silk, Worſted, Cotton, &c.

MADDER is a red colour, the beſt grows in *Holland*, though the colour of that which grows in *Flanders* exceeds it; each ſort of madder is mark'd with a particular mark, to know what country it comes from. The only ſign of the real goodneſs of madder, is the bright colour, which when being ground to a fine powder, and put on a blue or brown paper, ſticks to it: it muſt be kept cloſe from the air, otherwiſe it will looſe the ſtrength, and beauty of its colour.

The madder which comes from *Sileſia*, under the name of *Breſlaw* red, reſembles more a red earth than a root, it has not ſo bright a colour as that which comes from *Holland*: to manure and cultivate the ground for the growth of madder, it muſt be obſerved, that it requires a good mould, which is neither too damp nor dry, it muſt be plow'd pretty deep, and be well dung'd before the winter ſeaſon. It is ſown in the month of *March* in the decreaſe of the moon, after the land in which it is to be ſown, is well clear'd of weeds, leaſt they ſhould attract the ſtrength and goodneſs thereof to themſelves, and their roots mix with the madder.

About eight months after the madder is ſown they begin to pull up the larger roots thereof, which is done to hinder it from drawing the ſtrength from the earth to themſelves, which are to be a nouriſhment for the younger ſprouts; this is commonly done in the month of *September*, when the ſeed is ripe for gathering. The remaining roots are then well covered with mould, till the next year, when the larger roots are again gathered; thus it is managed 8 or 10 years together, after which the ſpot of ground may be cultivated for the growth of corn, and a new plantation fix'd upon in another place.

The roots of madder which grow in *Flanders* and *Zealand*, when pull'd out are dry'd in the ſun; but in hot countries they are dry'd in ſhady places, in order to preſerve their colour and ſtrength; after that they are ground in mills to a powder, and pack'd up cloſe in casks or in double bags.

The freſh madder yields, a lively colour, that of a year old a more lively one; but after that time the older it is, the more it loſes both its ſtrength and beauty.

Concerning the Dying with Madder.

IT has been a common rule to take to eight pound of madder, one pound of tartar; allum and tartar are uſed for preparing the commodites to be dy'd, for atracting and preſerving the colour.

Pot-aſhes heightens the colour very much, as does bran-water; brandy is of peculiar uſe: it atracts the colour, makes it look clear and fine, and frees the ſubtileſt particles from its dregs and impurities. Some dyers, and indeed moſt, aſcribe the ſame virtue to urine; but this is falſe, and although it may be of ſome uſe when freſh, it is highly prejudicial to light colours when ſtale, for it expels its particles of ſalt too much, and cauſes the colour to be of a heavy and unpleaſant hue: this ought therefore to be a caution to ſuch as would dye light and tender colours. The experiment may be tryed in a glaſs of clean water, in which latmus, being firſt diſſolved and filtred, is poured in; if to this liquid, which is blue, you pour ſome ſpirit of ſalt, it will turn red, and mixing it with ſome diſſolved ſalt of tartar it will reſume its former colour; if you pour too much of the latter, the liquid will turn green, and thus you may change the colour by adding more or leſs of either the one or the other ingredient to it.

To dye Silk of a Madder Red.

PREPARE it as has been directed under the article of dying ſilk of a crimſon colour. This done put a pail full of river-water into a copper, together with half a pound of madder; boil it for an hour and take care it boils not over; then let it run off clear into another veſſel, ſtirring into it one ounce of curcumi; then put in your ſilk, let it lay therein till cold, then wring it out and beat it; this done take half a pound of good braſil-wood, boil it in bran-water for an hour, clear it off in another veſſel, and put in your ſilk; rince it out in ſoap-lee, and then in runing water; after which dry and dreſs it.

Another Method.

AFTER you have prepared your ſilk for dying, hang it on ſticks, and to each pound of ſilk, take eleven ounces of madder, and four ounces of nut-galls; put theſe into a copper with clean rain-water, hang in your ſilk, and augment the heat of the copper till it is ready to boil; then turn your ſilk in it for half an hour, and prevent its boiling by leſſening the fire; after this rince and beat it out, hang it again on ſticks, in a tub with cold water, in which before you have put ſome pot-aſhes; this gives it a beauty; then rince and dry it. How this madder is made uſe of for dying of worſteds or ſtuffs, has been ſhewn already.

Of Cochineel and its Uſefulneſs in Dying.

COchineel, a coſtly fine red and purple-colour, are ſmall dry'd inſects, in ſize of bed-bugs, which when brought into a powder and boiled, do yield a beautiful red colour, they are uſed by ſcarlet dyers, for dying of ſilks, worſteds, cottons, *&c.* they are imported from the *Spaniſh Weſt Indies*, the inſect feeding on a fruit which has a red juice ingendered with the tincture thereof. The *Indians* ſpreading a cloth under thoſe trees, ſhake them, and by this means catch the inſect, where they ſoon dye. This is the manner of preparing cochineel.

Of Kermes, and its Uſe in Dying.

THIS grain, by ſome called ſcarlet berry, on account of its containing that choice and noble colour, ſcarlet; grows in *Poland* and *Bohemia*, on ſmall ſhrubs; they are about the bigneſs of a pepper-corn; the beſt comes from *Spain*; it is alſo found in *France*, eſpecially in *Languedoc*, and is gathered in the latter end of *May*, and the beginning of *June*. In *Germany* theſe berries are among the vulgar call'd St. *John's Blood*, becauſe of their being found on the ſhrubs about *Middſummer*, or the feaſt of St. *John the Baptiſt*.

The *Poles* call it purple-grains; they grow very plentifully in that country, and that people firſt diſcovered its virtue for dying of crimſon and purple, by a hen picking thoſe berries, and diſcharging her excrements of a crimſon colour. The diſtrict about *Warſaw* affords great quantities. In the *Ukrain* they are ſtill in more plenty; and on the borders of the ſandy deſarts of *Arabia*, they are gathered with great pains by the poor people, whence, it is thought, they retain the *Arabian* name of *Kermis*: thoſe berries or grains, when ripe, contain an inſect of a crimſon red, which, if not timely gathered, will diſengage itſelf from the ſhell and fly away; wherefore the people watch carefully the time for gathering, when they roll them together in their hands into balls, dry and ſell them to the *European* and *Turkiſh* merchants. The *Dutch* mix it among the cochineel, becauſe it cauſes that colour to have a higher and finer hue.

Of Indigo.

INDIGO is a dry and hard blue colour, which is brought to us in lumps of different pieces or ſizes; it is an *Indian* ſhrub, which at certain times of the year, when in bloſſom, is cut down and laid in heaps, ſo long till it is rotten; then the *Indians* carry it to the mills, which are built in great numbers about that place, where it is ground, boil'd and preſs'd, and when it is dry'd, they cut it in pieces, pack it in cheſts, and ſend it abroad.

There are ſeveral different ſorts of indigo, *viz.* indigo *Guatimala*, and indigo *Lauro*, both which are exceeding good and fine; their goodneſs is known when in breaking they appear of a high blue, and not ſandy; however that with a deep gloſs is not amiſs. Theſe two ſorts ars followed by theſe, *Plato*, *Xerquies* and *Domingo*, which are counted not ſo good as the former. The *Indigo Plato* and *Xerquies*, are of a high violet colour, and very light in weight, ſo as to ſwim on the water; theſe are by ſome reckoned better than that of *Gautimala*, becauſe it is preſs'd only from the leaves, and the other from the ſtalks and leaves together. *Indigo Domingo* is not of ſo lively a copper colour as the former, and is much mix'd with ſand and earth; the merchants try this ſort by lighting a piece, the good ſort will burn like wax, and leave all the droſs behind.

Curcumi.

IS a foreign root in the ſhape of ginger, of a ſaffron colour; it is brought to us from the *Indies*, where it is made uſe of both for dyers and ſpice.

It is alſo call'd the *Indian* crocus, the beſt is that which is heavy and in large pieces, without duſt: there is no fitter ingredient to be found for heightening the ſcarlet to a yellow hue, and it is frequently uſed by colour-dyers in tempering theit reds, be they dy'd with kermes, cochineel, or madder, aqua-fortis will do the ſame, but curcumi adds a greater life, eſpecially to ſcarlet.

Braſil-wood.

THIS comes from the country of *Braſil* in the *Weſt-Indies*, it is cut out of a tree call'd by the inhabitants *Arbontan*; which, with its ſtem and branches is not much unlike an oak-tree, only thicker, ſome will meaſure 24 foot round the ſtem; the leaves reſemble thoſe of box-trees: the fineſt braſil-wood is cut about *Fernambuca*, a town in the country of *Braſil*, this exceeds in colour all the other kinds of braſil-wood, and is thereof ſold at a dearer rate: this wood produces in dying of ſilks, *&c.* a fine colour, but it is very fading. It is beſt for black-dyers, who by uſing it with gall-nuts, *Sumach*, *Rodoul*, *Fovic*, vitriol, and verdigreaſe, dye a good black or gray therewith.

Orchal.

ORCHAL is prepared from a ſmall moſs which grows on rocks and cliffs, the chief ingredients for its preparation are chalk and urine, and although the colour it produces in dying of ſilks, *&c.* is fading, yet whilſt freſh, is exceeding beautiful.

Orlean,

COMES from the *Weſt-Indies*, either in ſquare pieces like *Newcaſtle* ſoap, or in round lumps, or ſmall cakes, the bigneſs of a crown, which laſt is reckoned to be the fineſt ſort, and has a fragrant ſmell of violets ; it is a tincture preſs'd from a ſeed, and when dry'd, of a dark-red yellow colour. The druggiſts ſell two ſorts of orlean, the one is like a dough and is very cheap, the other is dry and very valuable. The dyers uſe it for dying of brown-yellows, orange-colours, *&c.*

Gall-nuts

IS a fruit of various ſorts, ſome are ſmall, others large, black and white, ſmooth and knotty ; they grow on high oak-trees, and by merchants are imported from *Smyrna*, *Tripoly*, *Turky*, and *Aleppo* ; the heavieſt are counted the beſt, eſpecially when black and knotty.

FINIS.

AN

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